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Siderosis and Wet Water

During the study of some thirty preprints of Papers presented earlier this month to the St. Louis meeting of the American Foundrymen's Society, we were particularly impressed with the worth of one by Mr. Herbert J. Weber on " Industrial Hygiene in the Foundry." An early interesting commentary by Mr. Weber is that " many a compensation claim has been paid when the disability was due to syphilis rather than lead, or due to cancer of the lungs rather than silica." This strange statement will come as no surprise to those familiar with the American foundry industry. When racketeering was at its worst, it was not unusual for a " set-up," consisting of a crook fettler, a crook doctor and a crook lawyer in certain States, to sue foundries for compensation for disability through silicosis. The causation of this disease is said to be governed by three factors:—(1) The particles of dust must be below 5 microns in size; (2) concentration of dusts must be greater than 5 million particles per cubic foot of air per 8-hour day, and (3) exposure must be long enough—2 to 25 years (average 10) are usually required. A useful reminder is given that foundry dusts are not 100 per cent. silica. There can be, for instance, iron oxide fumes and iron, being the great colouring matter of nature, may quite harmlessly tinge the lungs, just as a tatooist tints the skin of his patrons. Unfortunately for both patient and foundry owner, medical diagnosis may through this cause be confounded.

The main source of this pigmentation or siderosis apparently arises from the burning-off of the runners and risers of steel castings. Mr. Weber relates his personal experience of this subject in the following quoted paragraph: " In the cleaning room of one of the writer's manganese steel plants, there was an unusually large number of cases of what appeared to be silicosis. These cases were incompatible with the industrial hygiene findings of exposure. Dust concentrations of free silica were so low that a diagnosis of silicosis seemed unwarranted. Accordingly, a $15,000 animal experiment was begun in conjunction with the Saranac Laboratories at Saranac Lake, New York. The experiments lasted 18 months. The same airborne dust that our men were breathing was collected and sent to the laboratory, where the test animals were subjected to the inhalation of this particular matter. The animals were X-rayed periodically to determine if the same nodulation could be developed in their lungs that were seen in our grinders and burners. Finally, after 18 months, the same X-ray pattern was noted. The animals, upon being sacrificed, showed no fibrosis, no disease, but they did have the iron deposits characteristic of siderosis. This was proof that the original diagnosis of silicosis in our burners and grinders was unwarranted, as the industrial hygiene findings indicated."

The Author of this Paper strongly recommends the investigation of the use of wetting agents. We confess to complete ignorance of such substances as applied to water.* Here again we must quote to give the full significance of the Author's findings: " We succeeded in reducing dust at a manual shake-out 85 per cent. by using wet water on the flasks before shake-out. Sand so treated, according to the moulders, at least produced the best moulding sand they had ever used, because it was uniformly moistened. . . . Wet water is most effective for moistening floors before sweeping. Ordinary water will cause mud and will not penetrate. One of the largest steel companies found that wet water penetrated as much as 3 ft. into the sand, whereas ordinary water produced surface mud. In our own tests, cores soaked in wet water showed complete

*See overleaf.

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Siderosis and Wet Water

(*Continued from previous page*)

penetration of moisture, whereas in a comparable time ordinary water showed a skin penetration. Obviously, cores can be quickly removed with less dust if they can be treated with wet water. Nozzles spraying wet water over a Royer have been very effective in allaying dust. There is a possible application of wet water to sand mixers and mullers. This may save the cost of expensive exhaust hoods. Foundry windows can be washed quite easily with water treated with a wetting agent, provided there is no encrustation from the past years." We have never read a Paper on industrial hygience which is more stimulating to action than Mr. Weber's effort and we offer to him our congratulations.

Wet Water

After writing this week's leading article, we communicated with the National Physical Laboratory and were informed that wetting agents are made by the Shell Chemical Company (Tepol); Imperial Chemical Industries, Limited, and the Monsanto Chemical Company. The wife of our informant at the N.P.L. uses "Tepol" for washing woollens, paint and crockery.

Anti-Corrosion Practice

Recent advances in British anti-corrosion research and practice will be explained and illustrated to the *Associazione Italiana di Metallurgia* at their meeting in Milan from May 26 to 29. Dr. J. C. Hudson, head of the B.I.S.R.A.'s Corrosion Laboratory in Birmingham, will present a Paper on the protection of iron and steel surfaces against corrosion and will exhibit a short film on flame-cleaning, prepared by Mr. F. Fancutt in the Research Laboratories of the British Railways at Derby. The subjects to be discussed at the meeting are the study of surfaces and the metallurgy of welding.

A. C. WICKMAN, LIMITED, of Coventry, machine-tool builders, have furnished themselves with a striking mobile demonstration unit, which is now touring the Continent of Europe. It carries three machines:—A 1⅛-in. multi-spindle bar automatic; a ⅞-in. sliding-head automatic, and a Wickman optical profile-grinding machine. There is space for 1½ tons of bar stock and 150 galls. of coolant oil. All three machines can operate simultaneously. The unit is now in North Italy. It will later visit Switzerland, France, Scandinavia and Spain.

It would also surely be in the best interests of all concerned if Meehanite could be related more specifically to our national specifications for high-duty cast iron. I can find no reference to B.S.1452 in the Paper.—Yours, etc.,

ARTHUR B. EVEREST.

The Mond Nickel Company, Limited,
Sunderland House, Curzon Street,
London, W.1.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

THE MONEY VALUE OF "REMELT"

To the Editor of THE FOUNDRY TRADE JOURNAL

SIR,—With regard to whether "remelt" should be costed at the price of bought scrap or at the founder's mixture price, it depends on prevailing practice and the metallurgical results obtaining at each foundry.

If a cupola can be charged solely with "remelt" and delivers metal of the same composition and physical properties at the spout, then evidently the mixture price is the correct one to adopt. But if a percentage of pig must be added to correct any deviation in analysis, etc., then the value of the remelt is proportionately lowered.

This proportion can be determined experimentally by each foundry manager, but will then be of true use to the cost department only if the practice at the foundry is to use the "remelt" as a separately calculated portion of the charge from the bought scrap.

If "remelt" is not segregated, but returned to the bought scrap pile and used indiscriminately with this in making-up the charges, then its value to that foundry is only that of the bought scrap.—Yours, etc.,

P. L. GOSSLING,
Director.

The Reliable Ironfoundry, Limited,
Archway Road, Leagrave,
Luton, Bedfordshire.
May 19, 1949.

ENDURANCE OF HIGH-DUTY CAST IRON

To the Editor of THE FOUNDRY TRADE JOURNAL

SIR,—After reading the abstract in your issues of April 14 and 21 of Mr. Campion's lecture on "The Engineering Properties of Meehanite," I feel I must write to comment on the comparisons made between Meehanite and other types of cast iron. Meehanite is justifiably recognised as a class of high-duty iron outstanding for quality, regularity and reliability. In view of the high reputation it has established, therefore, it seems to me unfortunate that the author should have found it necessary to quote data unsupported by technical evidence. I would refer especially to Fig. 7 on page 338 of your issue of April 14. This shows endurance curves for three types of Meehanite compared with a similar curve for alloy cast iron; the latter is shown as markedly inferior. I have searched the text in vain for details of these irons, and as none is given, I feel that these curves are valueless and misleading. In point of fact the term alloy cast iron covers types with properties at least equivalent to the Meehanite range (in fact I understand some Meehanite is alloyed), and there can be no doubt that the "alloy" cast iron selected could not in any sense be regarded as representative. May I, therefore, respectfully suggest that if such comparisons are to be made, they should be on comparable materials and above all, in the interests of technical value, details of the materials considered should be quoted.

(*Concluded at the foot of column one*)

Production of Medium and Heavy Iron Castings*

Improvements for the Jobbing Foundry

(*Abridged Title*)

By G. W. Nicholls

The demands for heavy iron castings for engineering purposes has been increasing steadily for the past few years and with engineers calling for castings of irons of greater strength and in some cases of lighter sections and more complicated shapes, the difficulties of the foundryman have been greatly increased, especially in view of the shortage of first-class materials and high-grade labour. In some cases there has been a general increase in the number of rejected castings, principally as the result of inclusions and unsoundness caused mainly by bad workmanship and unsuitable raw materials. The onus is not solely on the foundryman's shoulders, for much can be done by the engineer himself, who when making his present urgent demands on the foundry for castings, could give more attention to the question of design, particularly to those features which affect mouldability, soundness and freedom from dangerous internal stress. Some have yet to appreciate that simplicity in design enables foundry production methods also to be simplified, thereby increasing output. It is time, therefore, that these designers studied foundry technology more closely, or allowed themselves to be guided by experienced foundry technicians, so that they could base their design on the simplest possible geometrical figure, avoiding, wherever possible, unnecessary projections as part of a main casting.

Progress in Methods of Moulding

This problem of design is not something new, for in 1925 a report issued on this subject stressed its importance by saying, "In the present stage of the development of castings, it is no exaggeration to say that the first essential toward progress is the design of a casting"; yet this problem is still current. A study of the comments made by various foundry technicians from different parts of the world makes this clear. In France the subject has been dealt with by M. Andre,[1] in Germany by Dr. Jungblath,[2] in the States[3] and in Brazil by Dr. Ernest Geiger.[4]

In studying this problem of design, the domestic scrap heap should be the foundryman's practical school of experience, for by such a study, components from the same patterns can be made correctly, but it is obviously unwise to wait for scrap to occcur before attempting to avoid it. A far more sensible idea is, on receipt of drawings, first to consider the best method of making the pattern and what should be the foundry requirements. It should be particularly emphasised that examination should be made to determine the best method of moulding at the lowest cost (at the same time achieving the best results) and arrangements made for such patterns to be periodically inspected both at the pattern stores and by the moulders. Badly-kept patterns produce poor moulds and slow down production.

The purpose of this Paper is to help to bring to the notice of designers and foundrymen, who have perhaps not seriously thought of the problems of the future, various factors which are considered necessary to enable the foundry to produce sound castings quickly and economically at the first attempt. These recommendations may be helpful in maintaining production in the medium and heavy iron jobbing foundries in the not far distant future, when the present shortage will be felt more acutely than it is to-day, and at a time when there is competition from the fabricating industries and internally. Under these circumstances castings in this country will have to be produced much more economically than they are at present.

CASTING DESIGN

Considering design first, the following points are worth mentioning:—

Breaking-down into Components

In the design of large engineering castings, consideration should be given, wherever possible, to breaking-down of large structures into components suitable for machine moulding, or, if this be not practical, provision should always be made for the easy withdrawal of the

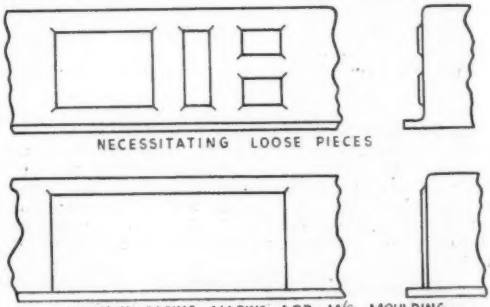

FIG. 1.—REPLACEMENT OF SEVERAL LOOSE PIECES BY A SINGLE FIXED PIECE.

* "Factors for Immediate Consideration in Assisting in the Future Production of Medium and Heavy Iron Castings," read before the West Riding Branch of the Institute of British Foundrymen, Mr. Hammond presiding.

Medium and Heavy Iron Castings

pattern equipment from the moulding sand without having to resort to the use of irregular parting lines and the use of loose pieces. Examples are shown in Figs. 1 and 2. Fig. 1 shows how several loose pieces may be replaced by one integral fixed piece, and Fig. 2. part (1), how a core-sand insertion may be made in a mould to reduce resistance in the direction of the arrow to permit casting contraction; part (2) shows how the component may be split up into two castings to simplify moulding. It is generally understood, that the more complicated the design, the more individual core boxes, etc., are required, which always have an adverse effect on the resulting accuracy and price of the finished component. It is better to make the design of a large construction of an assembly of several parts, which may be machined separately and fitted together later, using shoulders or pins for the alignment, and fastening the parts together by bolts or other means.

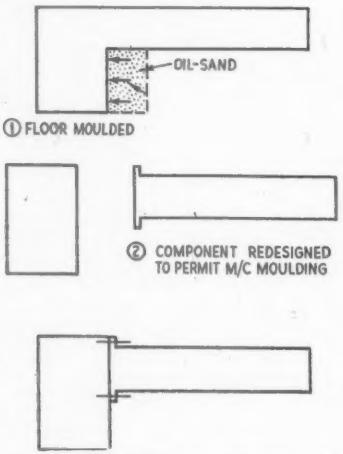

FIG. 2.—MODIFICATIONS FOR IMPROVED FOUNDRY PRACTICE.

At the same time, protruding parts such as isolated areas for facing and brackets or arms can be made from separate patterns, which, after casting and machining, may be secured and aligned to the principal body. All this will provide for an easier and more economical method of molding, than if they are incorporated in the one piece as a loose pattern to be moulded in the floor.

Pattern Construction

Patterns should be constructed to prevent warping, both during the moulding operation and during the extraction of the pattern from the moulding floor. They should be sufficiently braced to prevent patterns being torn loose by the initial high pressure to which an assembly is subjected when first drawn from the moulding sand.

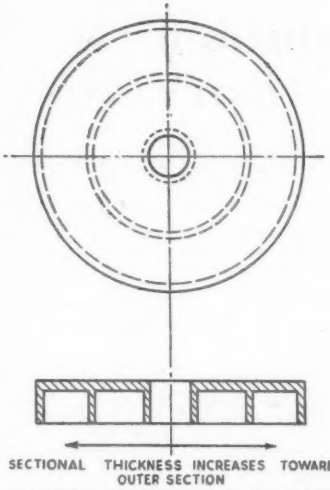

FIG. 3.—SECTIONAL THICKNESS GRADING ACCORDING TO DIAMETER, FOR STRICKLE MOULDING.

For large circular designs of castings, the moulds may be made with strickles, as in loam moulding, without the use of expensive equipment, and it should be ensured that such designs have a thicker section of metal at the outside, and not in the centre, as is shown in Fig. 3.. This possibility should be studied when designing such parts. In those foundries where heavy straight-jolt machines are utilised, and where usually one half of the pattern is jolted and then handed to the moulder to hand-ram the top portion of the mould, the moulding tackle available should be examined to see if it is suitable for the jigging of the pattern to the

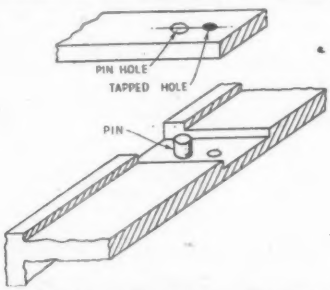

FIG. 4.—METHOD OF JIGGING THE PATTERN TO THE MOULDING BOX.

moulding box, as illustrated in Figs. 4 to 7. By such methods production times can be halved.

Before starting work on any large casting, a certain amount of engineering and planning is necessary to determine the proper method of procedure. The drawing should be checked carefully and special consideration be given to the following details:—

(1) Ensure that the design permits easy withdrawal of the pattern from moulds and that unnecessary undercuts, bosses or facings are avoided. In cases where they are essential, see that any ribs or other protruding parts are so designed that they may be drawn, as fixed parts of the pattern, from the mould. (2) The individual cores must be kept to a minimum so as to reduce the number of chaplets required for supports. (3) The design of the cores must be such as to permit reinforcement by cast irons or loose rods when needed, and allow of the removal of the core irons from the cored holes with ease when cleaning the casting.

Contraction and Shrinkage

Many of the foundryman's problems arise from the engineer failing to take into account the contraction or shrinkage characteristics of the metal. Isolated heavy sections must be properly taken care of by gating and risering, or they must be eliminated. All sections of the casting should be as nearly uniform in thickness as possible, and when a change in section is necessary, it should be arranged gradually, otherwise, defects such as "shrinks," "hot tears," "cold laps" and "cracks" are bound to occur, as well as the possibility of excessive internal stresses which might later cause failures.

Corners at adjoining sections must have ample fillets to prevent tears and cracks, but care must be taken to avoid being too generous. Over-size fillets tend to create hot spots which also are liable to occur at "T" and "X" sections. The thickness of sections of castings must be so proportioned as to permit steady flow of metal, and sections which would interrupt this and cause cold shuts should be avoided.

Patterns should, if possible, permit cores to be vented from the top to permit easy escape of gas. They should be so designed that the castings can be filled from the bottom, except in special cases, even though it may be necessary to use specially-prepared runners to introduce the metal into the casting at the bottom. A part should be so designed that it may be moulded with any machined surfaces in the bottom side of the moulds, as this side of the casting is the easiest to produce with the least blemishes. The designer can aid in this by designing the part for easy drawing of the pattern with the machined-side downwards, and also by avoiding designs which necessitate moulding horizontal surfaces of large area with contouring sections which are inclined to cause internal stresses and shrinks.

Abrupt changes of section and sharp corners should be avoided and the design should be such that, on cooling, no part of the casting is unduly stressed either by tension or compression in places where free contraction is interfered with. Parts containing sections likely to cause shrinkage should be so arranged that, when moulding, provision can be made for the shrinkage to occur in feeder heads or feeder runners. Cavities and shrinkages are liable to appear in the heaviest sections, particularly where ribs or bosses join the main section and, therefore, progressive solidification from the bottom to the top should be aimed at and if for any reason of design this is not practical by normal methods, resort should be made to the use of denseners.

Metal Composition

Closely associated with the problems of design is the question of metal composition. Designers, whilst knowing the service required from the casting, rarely specify the physical requirements of the metal on the drawing, but simply state, "Cast Iron," "Close-grained Iron," or "Meehanite." They are generally aware that there are six grades indicated in British Standard Specifications, for when a component fails mechanically in service, they invariably state that the iron is not strong enough and should have been made in a higher grade.

FIG. 5.—PATTERN SHOWN JIGGED TO THE MOULDING BOX, WHEN USED IN CONJUNCTION WITH A HEAVY JOLT-TYPE MOULDING MACHINE.

Heavy Iron Castings

The foundry metallurgist must seek such information. He should ascertain the most important surfaces and the service requirements demanded, and thus, with his knowledge of the characteristics of his available specifications, produce the most suitable metal. Many times, alloy additions are specified which are unnecessary; on the other hand, it *is* sometimes necessary to make an addition of alloys to meet the particular service which is demanded. Knowing the metal specifications, the temperature of pouring can be decided, as well as such details as the most suitable moulding sand and mould dressings.

The metal specification has also a bearing on the running and risering of a mould, as each grade has different running properties, liquid shrinkages and solidification characteristics. For example, with increasing tensile in the British Standard Specification, the easy-running characteristics of the metals decrease and the shrinkage likelihood increases. This is caused by the effects of the various elements present.

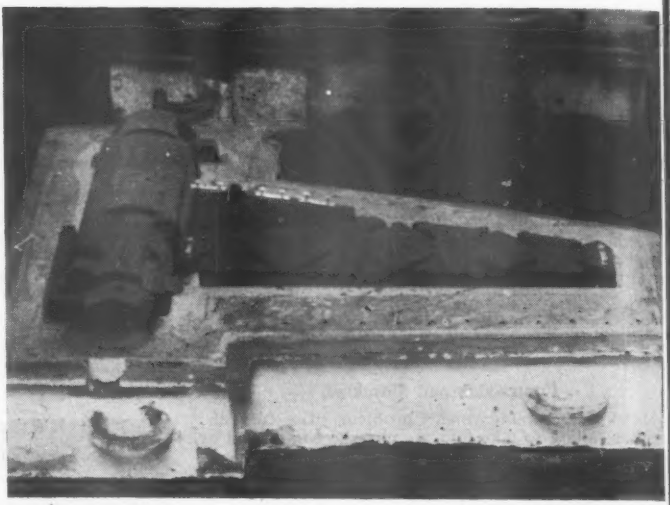

FIG. 7.—SAME JOB AS FIG. 6, SHOWING THE MOULD CORED-UP READY FOR RECEIVING THE TOP PART.

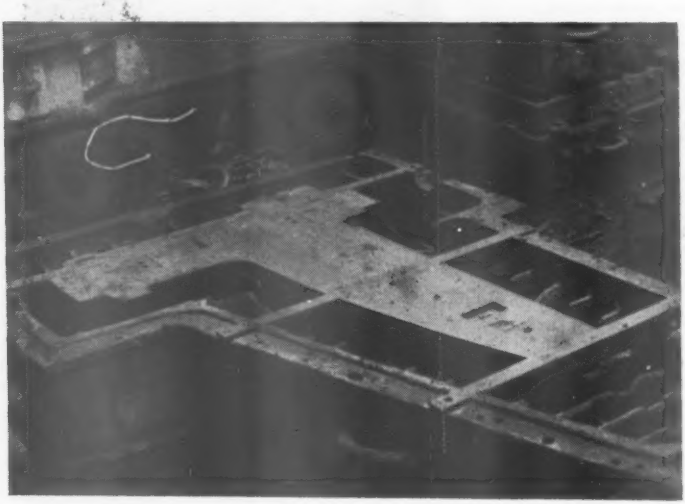

FIG. 6.—FURTHER EXAMPLE OF JIG-LOCATION OF A PATTERN IN THE MOULDING BOX.

Difficulty with Deep Joints

One of the most uneconomical features of floor-moulding heavy castings of an intricate design (Fig. 8) is the necessity of having to make deep joints. These absorb, in some cases, as much as 50 per cent. of the labour charge in preparing the mould. In many cases, these joints could, by modification of design, be reduced by such an important amount as to have an appreciable effect on the cost of the castings, thus, also, further assisting in improving output by releasing the skilled moulder earlier from each job. The subject was clearly expounded by F. C. Edwards[5] in 1933.

From a study of his remarks it is apparent that much more can be done by the foundry to exert pressure on all concerned to eliminate faulty casting design, whereby foundrymen may reduce their losses, increase production, improve their products and save vital raw materials.

MOULDING RECOMMENDATIONS

The responsibility for all rejected castings must not, however, be placed on the shoulders of the designer, for many are the result of bad workmanship in the productions of moulds and cores (or both), and errors made in assembling moulds, which could be avoided by taking more care and giving greater consideration to essential points. Common amongst the moulder's mistakes are mis-placed cores, sealed and forgotten vents, badly-placed studs and chaplets, "crushed" moulds and mis-placed runners and risers.

Runners and Risers

In considering the runners and risers, their main function is to allow for the casting to be properly run and fed. The running system should be of such construction as to allow a uniform and smooth passage through which the metal will flow. The main downgate should be of approximately 1⅓ to 1½ times the total area of the ingates, and the runner of the system, which should include any device for trapping dirt or slag, should be approximately 1¼ times the total area of the ingates required. The latter should be of such a design as to be increasing in cross-section to reduce the velocity of the metal. Risers and feeder-risers should be placed so as to feed the castings properly and at the same time not interfere with the purpose for which the castings are to be used.

FIG. 9.—SAND GRAB USED IN PREPARING MOULD PITS.

FIG. 8.—EXAMPLE OF A DEEP-JOINTED MOULD FOR A CASTING OF INTRICATE DESIGN.

The use of side-feeders is to be preferred to top feeders and, where exceptionally heavy sections occur, the "neck" type should be used. This design consists of a large heavy riser placed over a dry-sand core, which contains the small neck; this core becomes incandescent during casting operations, thus preventing the neck from freezing. Whatever form of feeder be used, however, the length of neck joining the feeder proper with the casting should be at a minimum, thus allowing maximum feeding to take place before final solidification occurs.

In running heavy castings, it is preferable to use a number of small runners rather than one large runner, and to provide for the metal to enter the mould with

Medium and Heavy Iron Castings

as little hindrance as possible, and in such a manner that the hottest metal enters the thinnest sections first. Furthermore, it is important to remember that the runner system withstands more arduous conditions than most parts of the mould and, therefore, requires more attention. The ingates should be made as short as possible, so as to reduce the tendency to pick up dirt and to unduly cool the first metal.

Cores

In most large jobbing foundries, the cores and the actual mould are made by different personnel. It is wise policy, therefore, for the moulder to check all cores to see that they are sound and that all vents are open. Coremakers, many of whom have graduated from unskilled and semi-skilled jobs, should remember that lack of a vent in a core is the common cause of a blow-hole in a casting and they should see that an adequate amount of ashes is placed in its correct position near to the top of the core so as to allow free exit for gases. When a core is to be used without chaplets, a correctly-shaped and strong core iron should be used; the use of loose irons being avoided. Care should be taken that the core iron is not placed too near the core face, otherwise cracked castings may result, also all cores should be blacked adequately. In the case of those which will be exposed in the heavier sections of metal, also at the lowest point of the mould, it is preferable to apply a number of thin-layers of blacking rather than one thick coating, as the latter has a greater tendency to flake off.

Most of the problems of how to place and secure the core, and where to bring off vents, should, of course, be solved before a job leaves the drawing office. For, in large jobbing work, it may be necessary to secure and vent many tons of cores. By going over the design in the drawing office, it may be found that the designer wishes to incorporate a cored-out compartment and yet has allowed no way to secure or vent the core. In those cases, it will be necessary to arrange a hole in the casting, which can be plugged at a later stage of manufacture.

Casting Procedure

After achieving the perfect design of casting and a carefully prepared mould, there is still the casting operation to consider. Here it is important that all ladles should be kept clean, properly dried and preheated ready for use and that the metal should be properly skimmed. This last operation should be performed over the opposite lip of the ladle to that used for pouring. Pouring should be carried out by filling the runner bush as quickly as possible, using a piece of perforated tinplate, etc., over the downgate to check the first rush of metal, and keeping the metal well up in the bush during the operation.

Many designers consider that the quality of their castings begins and ends in the foundry; the foundryman in turn considers that he is not responsible for poor design; but if each in turn will remember that the cost of a casting and the problems of moulding are directly related to design, then the future of both the foundry and engineering industries can be greatly assisted in meeting heavy engineering competition from abroad, most probably at a time when the labour position in the foundries is more acute than it is to-day. Further, let all foundrymen train their personnel to use their skill to avoid waste of vital raw materials and labour.

Supply of Skilled Labour

The problem of adequate skilled foundry labour is still acute and is a problem which must be solved in the very near future; otherwise, the consequences may be serious. Recently Sir Alfred Herbert, in a communication[6] to the Institution of Production Engineers, made comments on the position of foundry labour which are well worth study.

The position of skilled moulders obtaining in the West Riding of Yorkshire is set out in Table I. It will be observed that according to numbers in each age group, the position in 10 years time will be desperate unless there is a greater influx of apprentices. The cause of such an alarming state of affairs in a basic industry dates back some considerable time, and much of the onus must be placed on the managements for not attracting the right type of youths, encouraging them to study, and seeing that their training involved all the aspects of foundry practice. Instead, any boy was usually accepted in the foundry trade, and the question of whether or not he acquired any theoretical knowledge as to why certain processes were necessary was not considered important. The result is a serious shortage of first-class craftsmen.

TABLE I.—*Typical Age Groups of Skilled Moulders in the West Riding of Yorkshire Area.*

Age group.	Number employed.
60–70	7
50–60	10
40–50	5
30–40	10
20–30	6
16–20	5

The production of castings is not a simple matter, for a high degree of technical skill must be exercised in the control and carrying out of all operations in order to benefit the industry and to produce quality goods. Foundrymen must at all times be endeavouring to improve quality at no additional cost; also to establish dependability of castings by proper methods of moulding and control of the uniformity throughout the entire process, from the raw materials to the finished product.

Raw Materials

A serious problem in jobbing foundries is the question of pig-iron supplies. In most cases, the tonnage allocation granted by licence is sufficient to meet the over-all requirements, but in many cases even after careful study of grade requirements, the correct types are not available or fully delivered at the end of the licensing period. This means the adoption of non-standard melts, involving the use of steel or of greater proportions of steel than normally used, so that much

greater care must be taken in melting, and, often, resort must be made to alteration in the moulding practice normally employed.

It is proposed, therefore, to describe some of the problems encountered in making large castings, and some of the methods used to solve them. The recommended methods are not to be construed as infallible, nor is it suggested that they are the only satisfactory ones, but they have, in many cases, been used with improved results for the casting. In some foundries, the methods may not be considered the most economical, but when a casting of many tons is to be made, it is felt that the most economical way to produce it is by methods offering the greatest possibility of success, since one defective casting most definitely increases the cost.

Rules for Moulders

One of the first problems often encountered in a jobbing foundry is the great divergence in skill between the moulders employed. Some know the requirements for the successful moulding of any components, whilst others always fall down on small but important matters either through lack of knowledge or through forgetfulness. Therefore, to assist the latter type of workman, the Author had the following rules exhibited at the entrance to the foundry:—

(1) Take care with your ramming, as soft-rammed work produces swollen surfaces, whilst hard ramming produces scabs.

(2) Always reinforce your mould wherever necessary.

(3) Use sprigs on your mould surfaces, particularly in front of runners, as these help to prevent sand wash, drops and scabs.

(4) Do not use the water brush excessively on green-sand moulds as this will only produce blowholes in the casting.

(5) Use the vent wire or rod wherever possible.

(6) Finish the contour of the mould cavity to that of the contour of the pattern.

(7) Apply mould blacking in its correct consistency, as watery blacking will permit molten-metal penetration.

(8) See that your cores are in good condition, do not risk using faulty cores.

(9) Connect all vent channels efficiently. This will prevent unnecessary gas passing into the mould.

(10) Reinforce cores correctly and see that they are properly vented.

((1) Do not use wet sand for runner bushes on dry-sand moulds, tone it down to green-sand consistency.

(12) Make certain that your gating and runner system effectively chokes back the metal to the runner bush.

Many other rules could be included, for instance (*a*) an increased amount of sleeking may cause scabs and buckles; (*b*) 90 per cent. of the dirt in a casting is gathered between the runner box and the mould cavity; (*c*) runners should be deeper than the ingate and should run beyond the ingates to dirt traps.

MAKING LARGE CASTINGS

Necessity for Records

Before proceeding to outline the general manufacturing procedure for heavy castings, and make reference to a collection of important points to be observed, it should be mentioned that in a jobbing shop where a wide variety of castings are made, it is important that complete records of the successful and unsuccessful moulding techniques for each casting be kept. The records should include information relating to risers and runners, dimensions, time of mould drying, number of holes, camber allowance, etc., so that at any future date the casting can be again made successfully by relating the new procedure to the record.

Preparing the Pit for Heavy Castings

In preparing a pit for heavy castings, the over-all dimensions of the pattern having been obtained from the patternmaker, the problem of the enormous amount of sand to be removed is encountered. The method adopted in most foundries is to dig it out by hand, which entails the employment of labourers for a long period. One method of solving this problem is to utilise a flat grab of the type shown in Fig. 9.

The prepared pit is then rammed with floor sand to about 15 in. from where the bottom of the pattern is to be located. A layer of approximately 6 in. of coke, ashes or the like is laid down on the top of this sand and vent pipes are placed in position leading from the coke bed. The coke is then covered with sacks or paper to prevent the following sand from being rammed into the coke. A 6-in. layer of sand, including a layer of facing sand, is rammed on top of the coke bed and levelled off to the bottom of the pattern, which may or may not include a camber allowance.

(*To be continued*)

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1 "Co-operation between Designer and Foundrymen," M. Andre, FOUNDRY TRADE JOURNAL, Sept., 1939.

2 "Co-operations between Foundry, Drawing Office and Machine Shop," Dr. Ing. H. Jungbluth, FOUNDRY TRADE JOURNAL, Jan., 1939.

3 "Design as Related to Casting Problems," a Paper presented in America before a meeting of the St. Louis Chapter of theA.F.S., published in the FOUNDRY TRADE JOURNAL, April, 1944.

4 "Designing for Foundry Production," by Dr. Ernest Geiger, Sao Paula, Brazil, *Transactions, A.F.A.*, July, 1942.

5 "Deep-joint Elimination," by F. C. Edwards, FOUNDRY TRADE JOURNAL, Vol. 48, p. 251.

6 "The Art and Mystery of the Foundryman," by Sir Alfred Herbert, K.B.E., *Proc. Institution of Production Engineers*, Jan., 1947.

Forthcoming Events

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

MAY 28.

Institute of Industrial Supervisors, and County Borough of Smethwick Education Committee.

"The Foreman and Works Management," by A. P. Young, O.B.E., at 10 a.m., at the Chance Technical College, Crocketts Lane, Smethwick, Staffs. (This is the first of five lecture/discussion meetings, on Saturdays, devoted to the subject of Modern Foremanship.)

MAY 31.

Institute of Metals.

South Wales Local Section:—"Brazing," by H. R. Brooker, at the University College, Singleton Park, Swansea, at 6.30 p.m.

Corrosion Resistance of Iron Crucibles for Light Alloys*

A study of the corrosion of iron by light alloys carrying a high silicon content—Alpax and like—recently made by Dr. Bastien, professor at the *Ecole Centrale des Arts et Manufactures*, in collaboration with Mlle. Daeschner, has indicated that grey iron and especially blackheart malleable, were amongst the irons investigated which showed the highest resistance to this action.

Chrome and molybdenum additions did not improve the resistance of grey irons, and alloys of 30 per cent. chromium, as well as mild steel, were more liable to corrosion by direct contact with light alloys during melting. It is necessary, however, to note that the corrosion by a bath of liquid alloy is not the sole attack to which a crucible used for light-alloy melting should resist. Actually, for crucible practice there is also the resistance to the direct action of the flame. Systematic tests are to be carried out to compare the chemical composition of the crucible in relation to the combustion gases, but at the moment, practice demands, from this angle, alloys carrying a high chrome content. The fact that the internal walls of a crucible can be protected from the liquid bath by a coating, but that there does not exist, so far as is known, a similar method of protection for the external surface, supports the popularity amongst users of irons highly resistant to combustion gases at elevated temperatures, such as the high chromium alloys. This research has shown the importance to be attached when using metals or alloys as crucibles, to the protection of their inner walls by the use of such an extremely effective method as the application of a carefully-prepared wash.

* Translated from *Fonderie*.
[1] *Fonderie* No. 31, July, 1948, pp. 1217 *et seq.*

The Institute of Physics

At the Annual General Meeting of the Institute of Physics held on May 20, the *President*, Dr. F. C. Toy; *Honorary Treasurer*, Mr. E. R. Davies; and *Honorary Secretary*, Dr. B. P. Dudding, were re-elected for the year beginning October 1, and the following were elected to fill vacancies which will occur on that date: as *Vice-President*, Dr. S. Whitehead; as *Ordinary Members of the Board*, Mr. T. C. Keeley, Dr. H. L. Penman.

Keighley Association of Engineers

At the annual meeting of the Keighley Association of Engineers, held on May 20, a successful financial year was reported. Mr. J. Nicholson was elected *President* in succession to Mr. A. Connelly, and the officials to be elected to honorary positions were: Mr. C. J. Day, *Treasurer;* Mr. R. Shackleton, *Lanternist;* and Mr. N. Nunweek and Mr. F. Burton, *Auditors*. Mr. H. Smith, Mr. M. Baldwin, Mr. N. Holmes and Mr. A. Wood were elected to the *Council*.

South African Notes

The "Engineer and Foundryman" for April reports the visit of Mr. N. P. Newman, the President-elect of the Institute of British Foundrymen. He was the guest of honour at a cocktail party attended by the Council of the South African Branch of the Institute. For his short address he was cordially thanked by Col. A. H. Guy.

A second visitor to the Union was Mr. Oliver Smalley, O.B.E., president of the Meehanite Metal Corporation. Amongst many other engagements, he addressed a joint meeting of the Johannesburg engineering and foundry technical associations on March 31; on April 6, 7 and 8, attended a conference of the Meehanite Development Association, and on May 4 addressed a meeting in Durban.

A third visitor was Mr. A. E. Ireland, a service engineer on the staff of the British Moulding Machine Company, of Faversham, Kent. He has made an extensive tour of the Dominion.

Nickel Alloy Castings

The British Standards Institution has prepared a number of British Standards to form part of the series of standards for nickel and nickel alloys covering the various forms of wrought material, amongst which is:—1537:1949, Nickel alloy castings for general purposes.

The subject of the casting standard is continually under revision, and its scope will be extended when this is considered to be justified. Castings conforming to this standard are intended primarily for pressure vessels, excluding wear-resisting surfaces. They are intended specially for the use with chemical plant suitable for services up to 480 deg. C., and the silicon content is therefore limited to a maximum of 1.2 per cent. in order to prevent age hardening occurring in service.

Copies of this standard are obtainable from the British Standards Institution, Sales Department, 24-30, Gillingham Street, London, S.W.1. Price 2s., post free.

Publication Received

The Budget and Your Pocket. Published by H.M. Stationery Office on behalf of H.M. Government. Price 3d.

The perusal of this book by the *hoi-polloi* should at least do something in the direction of replacing instructions through the impact of slogans by thinking based on a series of over-simplified statements. That, at least, presents much progress. To the reviewer, the book shows most clearly that with the passage of more and more social legislation, the greater the amount of our money the State spends for us and the less there is for our own notions of spending. It can be supposed that the State knows best—but most of the more erudite would prefer to make their own decisions. Still, the book is a good threepennyworth.

Institute of British Foundrymen

Views on Precision Casting

South African Branch

The February meeting of the South African Branch of the Institute of British Foundrymen was devoted to the hearing of a lecture by Mr. J. J. Marais on the "Precision Casting of Metals." In opening the meeting, Mr. Teubes, the Branch-President, pointed out that the subject of precision casting was a new departure for South Africa. Before calling on Mr. Marais to read his Paper, he had pleasure in introducing Mr. Clifford Shaw (of Organo-Silicon Compounds), a brother of the inventor of the Osborn-Shaw process, which Mr. Marais discussed in his Paper. Mr. Shaw was in the Union to prepare the way for the manufacture of ethyl silicate, which had numerous uses in the foundry trade.

Lost-Wax Process

As this was the first Paper on the subject to be presented to this branch, the Author purposely made his introduction of an elementary character. He did, however, include his own impressions of the "Lost-wax Process," which were:—

(1) In order to work to great accuracy, this method of making precision castings requires extensive equipment and a highly-skilled and technically-trained staff to operate it.

(2) That the whole process from start to finish is a long and tedious business. It takes at least 20 to 24 hrs. to produce one cluster of castings.

(3) That the dies for making the wax patterns are liable to distort, and constant check must be kept on them.

(4) That any slight variation in wax composition will seriously affect results; also tremendous pressure must be applied to the wax in order to prevent excessive shrinkage and contraction.

(5) The wax pattern, after removal from the die, is liable to distort or sag, either through rough handling or temperature variation.

(6) Expansions and contractions of all materials used through the different stages of manufacture must theoretically be taken into account before the master pattern could be made.

(7) There is no means of inspecting the mould before the metal is cast into it.

Osborn-Shaw Process

He then outlined the Osborn-Shaw precision casting method in the following terms:—At this stage the Osborn-Shaw process does not claim to work to truer dimensional accuracy than the lost-wax process, but by virtue of its simplicity could be made ultimately to enter any field of industry. On the basis of the present cost of ethyl silicate, ordinary rough sand castings cannot economically be made, but where any significant amount of machining is involved, or where a high finish is required, or where an alloy is required that cannot be forged or machined, this process can be worked very economically indeed.

The cost of ethyl-silicate casting solution represents approximately 60 per cent. of the material and labour costs of the process. As the demand for ethyl silicate increases, so the price will materially decrease, and there is, therefore, no reason why this process of metal casting will not gain in popularity.

A master pattern (which is preferably slightly oversize) is made usually in a material which is readily machinable, such as brass. From this pattern, piece moulds are made in a good-quality dental plaster, which are negative to the pattern. From these negatives, positive patterns are made again in a specially hard plaster. It may be mentioned here that the master is made slightly over-size so that, in the event of the trial casting being slightly over-size, the correct size can empirically be arrived at by removing a bit from the master until the size is correct. Thereafter all the progeny of the master pattern will be consistent. It has also been found very simple and advantageous to work from plaster patterns, as the ethyl-silicate bonding fluid used in the moulding investment seeps into the plaster and strengthens it considerably. Furthermore, there is very little friction between the mould and pattern face.

Investment

The plaster patterns are now supplied to the production benches. A flask, made from waxed paper or any other suitable material, is placed over the pattern and catalysed slurry is poured in, of which the basic compound is ethyl-silicate casting solution loaded with a refractory filler to give a liquid slurry. This slurry is relatively stable until the addition of a few drops of a suitable catalyst is made. The amount of the catalyst added controls the gelling rate. Thus the mould could be made to set at any required speed. As soon as this addition is made, the slurry is poured into the flask, and a resilient gel of considerable strength and of a rubbery consistency results. When this reaction takes place, alcohol is liberated, which in turn facilitates easy stripping of the mould from the pattern.

Once the mould is stripped, the liberation of the alcohol is accelerated by setting the mould alight. The mould then changes from its rubbery consistency and becomes rigid. During this burning-off period the mould does not lose its shape or definition. The strength of the burnt mould is peculiar, inasmuch as it has a very sharply-defined collapse point. As a result, moulds, and particularly cores, can be made strong enough to withstand handling and the liquid pressure of the metal, but which will collapse when contraction takes place.

The mould portions, after being burnt off, are assembled, the portions being lagged together with catalysed slurry. They are then immediately placed in a muffle furnace and heated. If thin sections are to be cast, these moulds could be heated to red heat and the metal poured into them from the furnace spout imme-

Views on Precision Casting

diately after removal from the muffle. Otherwise excessive heating is not required. Since the material is a very poor conductor of heat, the cast can either be quenched quickly or allowed to slowly cool to room temperature. This characteristic can be invaluable when specific metal structures are aimed at.

Practical Details

The problems of gating, running, risering, etc., remain as in standard practice, but they are sometimes more easily dealt with due to the fact that (*a*) the mould could be heated up to any temperature required before pouring, and (*b*) the mould investment is a very slow conductor of heat, and, therefore, the cooling rate of the molten metal is much slower than in standard practice. The final castings have a perfect finish no matter what type of metal be used. Experience has also indicated that the tolerances achieved are adequate for the vast bulk of work available. Parallel faces or screw threads can easily be drawn in the investment used. The ratio between the weight of metal cast and that of the investment can be kept high, as the moulds could be stacked or the patterns clustered in order to economise in investment. A finished casting can be produced from start to finish within half an hour.

Very little space is required, and virtually the only equipment necessary is a small melting unit and a muffle or preheating furnace. For alloy steels a small high-frequency furnace is ideal.

DISCUSSION

The PRESIDENT thanked Mr. Marais for his excellent Paper on an unusual subject, which they had not previously had much opportunity of discussing. The process had been very clearly demonstrated. He thought they would all agree that a practical demonstration did far more to explain the process than any amount of spoken or written words could do. He then called on Mr. Jane to propose a vote of thanks.

MR. JANE, after congratulating Mr. Marais on the Paper, inquired whether the investment reclaimed from the moulds could be put to further use.

MR. MARAIS explained that the moulds were broken up and the material crushed under a roller and used for backing, but not for facing. The cost of the filler was by no means very great. The most expensive item was the ethyl silicate. The liquid material had a shelf life of three weeks and was not liable to gel for no rhyme or reason, but as soon as a catalyst was added it solidified. Mr. Marais then demonstrated this reaction, pointing out that this was actually the action which went on in the mould itself.

Union Production of Ethyl Silicate

MR. SHAW, asked whether supplies of ethyl silicate were available in the Union, said that sufficient material had been imported from Britain for development or experimental work. A plant had been designed and was about to be erected at Klipfontein which, he hoped, would be in production at the end of June, when ample supplies of ethyl silicate manufactured from entirely indigenous materials would be available in the Union.

Asked by the PRESIDENT for information regarding the cores used in the Osborn-Shaw process, MR. MARAIS said that the cores were assembled in exactly the same manner as in ordinary sand casting, except that they were a perfect fit. Naturally, the onus lay on the patternmaker to give the tolerances required. Another important point in favour of this process was that in the lost-wax process the die was split, whereas in the Osborn-Shaw process the mould was split, so that every mould could be inspected before being assembled for casting.

The PRESIDENT also inquired whether the investment had to be vibrated in order to do away with any air bubbles.

MR. MARAIS explained that in the lost-wax process the facing investment was only a few thousandths of an inch thick, whereas in the Osborn-Shaw process the wall was considerably thicker. Moreover, the backing material was only there for strength, so that the presence of air bubbles in the backing was immaterial. In fact, air bubbles were an advantage.

MR. JANE inquired whether there was any advantage in having the mould very hot for the purpose of preventing draws.

MR. MARAIS agreed that heating the mould before casting assisted in eliminating that tendency. The runners in the coal-cutter bit shown, for instance, were very small, and the metal remained liquid in the sprue much longer due to the low conductivity of the investment, plus the initial heating of the mould, and could therefore feed better. He had been amazed at the smallness of the ingates, runners and risers used in the process.

Commenting on Mr. Marais's observations regarding the nonchalant manner in which the catalyst seemed to be added by women operatives in England, MR. JANE asked whether these girls had any definite measure or simply judged by rule of thumb.

MR. MARAIS replied that new girls were given a measure, but seemed to acquire the necessary judgment simply through practice. Immediately the catalyst was added, the effect could be felt in the material, and he believed that the girls knew by the viscosity of the material when enough catalyst had been added.

Costs of the Process

MR. ALEXANDER was interested in the cost per lb. and also the density.

MR. MARAIS said that investment cost roughly a shilling per lb. and went a fairly long way. He believed that 28 lb. had a volume of 325 cub. in. These figures probably referred to sillimenite; crystobalite being lighter, the mould would take up a larger volume. He explained that in South Africa they would use silica or crystobalite, which was far lighter.

MR. COOMBS pointed out that Mr. Marais had made no mention of the difficulties associated with the lost-wax process. For example, the proportion of good castings was only 50 per cent., though he imagined that with the Osborn-Shaw process it must be higher. By ordinary sand methods 95 per cent. of sound castings could be obtained. Nevertheless, the lost-wax method was carried out on quite a large scale in the United States, where, during the war, one firm made as many

as 25,000,000 castings. Another point was that the reaction between ethyl silicate and a catalyst was rather a tricky one, which did not always go according to plan. Use had been made of certain agents known as condensing agents, which guided the reaction to form the silica. An interesting development was that, by this process, certain moulds had been made in a semi-permanent form and could be used again. At one time it had been proposed to use carbon for making these moulds, and he wondered whether this had been done. In regard to costs, he believed that, according to a Paper delivered by the two Mr. Shaws in 1945, the price of ethyl silicate was about 55s. a gall. in England, the opinion being expressed in the Paper that, due to increased production, it should have fallen by 1948 to 15s. Had that happened?

MR. MARAIS, in reply, said he did not know whether carbon material had been tried, but did not see why carbon inserts should not be used as chills where it was necessary to cool down the metal faster.

MR. SHAW said that he could answer Mr. Coombs because he had been responsible for the introduction of condensing agents. Unfortunately, the material had to be resilient when it gelled; otherwise it would be impossible to draw parallel sides, threads, bushes, etc., which could be done without any difficulty by the Osborn-Shaw process. This was not found with condensing agents. For repetition moulds with light alloys they could, and did, use the condensing-agent technique, but in the other instances it was necessary to have a mould which broke away from the casting. The limiting factor in repetition casting was not the production of a semi-permanent mould that would withstand high temperatures, but that low-melting point, and light alloys were released more readily from the mould. From the point of view of using carbon, sillimanite and other materials bonded more readily. With regard to price, since he made the statement referred to some two years previously, everything had gone up in price. Silicon metal had risen from £75 a ton to £130, so that his hopes for a reduction in the price of ethyl silicate had been shattered. He did bring the price as low as 21s., but a general increase of prices started and it climbed back to 35s. In South Africa the price should initially be in that vicinity, but if ethyl silicate was extensively used, it would soon come down.

Alternative Esters

MR. COOMBS said that esters were obtained essentially from the reaction of alcohols and acids, and hence a large number of silicon esters were available. Had any esters other than ethyl silicate been used? He also stated that malleable iron pipe fittings could be made by this process with the threads cast in.

MR. SHAW said that he had made the ester of every known alcohol and tried them for precision casting. The higher members in the methyl group were perfectly usable, but offered no particular advantages. One which he had developed was very promising because it was soluble in water.

MR. BILL said it seemed to him that the lost-wax process for the repetition production of castings was not economic. On the other hand, the Osborn-Shaw process certainly did seem to have probabilities. He also expressed particular interest in Mr. Marais's suggestion that the process might be used for pattern plates, as well as his further suggestion that it was the patternmaker who was blamed when things went wrong. He further asked what was the actual refractoriness of ethyl silicate. Finally, regarding the production of pipe fittings, he pointed out that in the malleable processes the essential basis of production was a white cast iron. How could a white cast iron be produced in a mould in which the conservation of heat was such that the metal remained fluid for such a time?

Specialised Applications

MR. MARAIS imagined that the process would be a boon to high-duty ironfoundries because the graphite precipitation would be 100 per cent. perfect due to better cooling. Regarding the production of a casting in white iron and then annealing to form malleable, he imagined that they would lose dimensions to a certain extent due to surface oxidation. On the other hand, he did not see why the moulds could not be broken while the metal was still red-hot in order to retain the white-iron structure. Alternatively, the whole mould might be cooled in an oil or water bath, or the silicon-to-carbon ratio might be altered.

On the subject of pattern plates, MR. MARAIS said that once a perfect master pattern plate had been made, a perfect pattern could be cast from it. Regarding refractories, the ordinary cupola refractories would be far too expensive if bonded with ethyl silicate. If a silica brick were bonded with pure silica, the refractoriness would be much higher than if it were bonded with lime. A zircon refractory bonded with ethyl "zirconate," when fired, would give the pure zirconia refractory.

MR. COOMBS suggested that chills could be placed behind the surface of the moulds, so that there was a second method by which white iron could be cooled. With many alloy steels the question of directional solidification was also important. Of course, it was necessary to feed castings with irons and alloys of that type.

MR. JANE said that master patterns would normally be made in timber, and the fillets, etc., would be put in with beeswax. The pattern would be varnished with shellac varnish. How would this be affected by ethyl silicate?

MR. MARAIS said that the varnish would be dissolved. It was better to use cellulose or wax.

MR. GODWIN asked whether it was possible to have a facing of investment and back it up with moulding sand. He would like to know whether it was possible to make malleable-iron pipe fittings complete in investment moulds. Assuming the iron was malleablised in the moulds, what would be the result?

MR. BILL could not see how, with very lengthy cooling, it was possible to make white iron. As Mr. Godwin had pointed out, if it were possible to cast in the mould and anneal at the same time, they would be solving a very long-standing problem.

MR. ALEXANDER could not see the Osborn-Shaw process being practised in an ordinary foundry. It would have to be undertaken with specially-trained labour and in a separate department of the foundry. Though there were certain resemblances, it was very different from the conception of moulding in a sand foundry.

Book Review

A Summary of the Proceedings of the Conference on Foundry Core-bonding Agents. Published by the British Iron and Steel Research Association, 11, Park Lane, London, W.1. Price 10s.

Held last autumn at Ashorne Hall, this conference created considerable interest, as the foundry industry has had to give much attention to the subject of core binders due to shortages and price increases of the normal raw materials. The reviewer takes exception to the opening statement made by Mr. W. M. Lord in his Paper "Gases Evolved from Cores," which reads: "Fumes produced from organic core binders constitute a nuisance in the foundry industry." Here and there, they do, but by and large they do not. The make-up of this book has been to deal with each of the three sessions *seriatim* and to include the discussions following the presentation of small groups of Papers. A bewildering array of substances was dealt with, yet the reviewer, having in mind the average, agrees with Dr. Newell when he summed up the situation by stating: "It had been made abundantly clear that the majority of founders would prefer to use the materials with which they were familiar, and particularly linseed oil." Yet, who knows, some of these newer developments may yet "sweep the field." Readers should certainly procure a copy of this report. It may prevent them wasting money in confirming established results and, on the other hand, it shows which of the newer materials is worth further investigation or even workshop tests.

Three-Score Years and Ten

The Brush Company, Limited, of Loughborough, this year celebrates the 70th anniversary of its establishment. It has issued in connection therewith a 16-page booklet giving the history of the concern and an illustrated description of its major products.

New Catalogues

Laboratory Apparatus. Griffin & Tatlock, Limited, Kemble Street, Kingsway, London, W.C.2, have sent us a 24-page catalogue, covering, *inter alia*, Dixon gauze rings; high-efficiency fractionating columns, and a heavy-element tube furnace. The last is a particularly pleasing piece of streamlined apparatus and makes those the reviewer used look like "Heath-Robinson" gadgets. The built-in pyrometer is an excellent addition. This catalogue is available to our readers on application to the technical director at Kemble Street.

Malleable Castings. A folder received from Hale & Hale (Tipton), Limited, of Dudley Port, Staffs, well serves its purpose as an introduction to the productions of the firm. A simple statement is made of the general mechanical properties, pictures of the foundry, a pattern and three castings are shown. Good use has been made of colour and the lay-out is well balanced. A second one deals with a high-duty alloy—called "Permalite," of the order of 35 tons per sq. in.—having good machining properties. This folder breaks one of the reviewer's tenets for enlightened trade literature in so far as micrographs are printed without giving a magnification.

Cupola and Converter Refractories

We regret that in our issue of May 19, when reporting statements made by Mr. D. Bird (Stewarts and Lloyds, Corby), in his Paper at the Conference on Refractories, incorrect figures for converter life were quoted. A six per cent. tar-dolomite mixture originally gave an average life of 213 blows, later reduced to 170. The present life for a thinner lining of stabilised dolomite averages 223 blows.

THE NEW AMBULANCE ROOM AT THE ELSWICK WORKS OF VICKERS-ARMSTRONGS, LIMITED (SHOWN ON LEFT), IS FITTED THROUGHOUT WITH "METROVICK" FLUORESCENT LIGHTING. "NATURAL" LAMPS HAVE BEEN INSTALLED TO ENSURE THE BEST POSSIBLE COLOUR RENDERING OF THE PATIENT'S SKIN, ETC. THE ILLUMINATION ON THE WORKING PLANE IS 45 LUMENS PER SQ. FT.

Institute of British Foundrymen

Venting of Cores and Moulds*

East Midlands Branch

DISCUSSION

MR. MEASURES said with reference to castings weighing up to 2 cwt. and their venting by means of artificial vents, that he had found that the use of a vent wire was an evil. He preferred to make the sand open in texture and to refrain from using any form of artificial venting. He thought more castings were lost through metal getting into the artificial vents than by using an open core sand.

MR. KILLINGWORTH, in reply, said that, generally speaking, he agreed, but there are many castings where artificial venting was necessary. It was normal practice to attempt to eliminate artificial venting, partly because experience was similar to that voiced by Mr. Measures, and partly because of the risk of inefficiencies with artificial vents. There were, however, certain drawbacks to extremely high-permeability sands, one of which was metal penetration with castings of 2 cwt. or over, and there was also the possibility of too rigid a core mix, causing finning, etc. He had found from experience with cores that where the gas escape was greatly restricted it was necessary to use artificial vents. One should, however, take very great care to see that the metal did not enter them during casting. No attempt was made to spread the artificial vents all over the core, they were confined towards the print end so that there was an easy escape. To try to put artificial vents in very narrow parts of sand was seeking trouble by seriously weakening the core, so that quite often the metal broke in during casting.

Balance between Gas and Metal Pressures

MR. HILL said he noticed that the calculated theoretical pressure were all slightly below the actual pressures developed. Could this be explained by the pressure developed from compression of air in the mould.

MR. KILLINGWORTH thought it was really more by chance that they were somewhat on the low side, and possibly equally fortunate that they were as near as they were shown to be. Actually the calculations were rather limited, and there had to be one or two good guesses or assessments. For instance, when the gas reached the back of the core, an allowance had to be made for the resistance of the moulding sand behind the core. Gas could spread out in the sand of the mould up to the moulding box, which was a solid impermeable plate, except at the joint, and to make a strictly accurate calculation for that was not possible.

MR. TIPPER asked two questions:—(1) Had the Author taken any actual measurements of pressure generated in larger moulds or cores during casting to compare with results obtained on the small experimental mould described? If this were possible, and the results were comparable, then he thought one could ignore the theoretical difficulties and complex calculations and use simple practical tests as a guide in production. (2) It was stated that much depended on the rate of gas evolution from mould or core, and to avoid risk of blown castings the balance between rate of gas pressure rise, and rise of liquid metal pressure must be maintained. The margin of safety was usually very small in practice. Could the author suggest a definite safe maximum pressure for any set of mould conditions, permeability of sand and weight of castings?

MR. KILLINGWORTH said he had made one or two tests with comparatively large moulds and cores. In the case of large cores, artificially vented, calculations were extremely difficult, and on actually testing in the mould he recorded a pressure which was somewhat lower than that calculated, but was nevertheless a fairly high pressure. He also tried the same experiment with a fairly small jacket core. Calculations again were difficult, and in that case the pressure was greater than calculated. The safety margin was obviously very small, as in several casts, identical in all possible ways, one or two would blow in rather an alarming fashion. One of the possible causes in that case, was the way the core was made by bedding in loose pieces, and he really had no definite idea how hard it would be rammed, and variations were obtained in the pressure developed. This was overcome by using a slightly more open sand with a fairly uniform grain size, and which it was not possible to ram so hard. That did help to cure that particular trouble. In reply to the question regarding whether it was possible to state any definite pressure for any set of conditions, it was not possible. There were so many variables to be considered, different depths of sand, different surface areas, and several factors which limited the rate of pour, etc. It was not possible to state that any definite pressure should be developed in a definite time, or such and such a sand should be used. Each case must be taken on its merits, but with a little more experience, it might be possible to arrive at some empirical formulæ embodying those variables.

Gases Forced Downwards

MR. MEASURES said it was most interesting to see in one diagram, showing a core projecting into the mould, was gasholes formed beneath the core. Did the Author consider that these gas holes were brought about from the core? He always found that core

*Discussion at Loughborough (Mr. H. P. Radford presiding) on January 29, of the Paper by D. Killingworth, which was printed in the JOURNAL, April 22, 1948.

Venting of Cores and Moulds

gases had a tendency to rise and it was most difficult to make them descend. In similar cases, he had generally attributed this to impurities in the metal becoming lodged on the under side of the core, and giving off gases which could not get round the core. It never occurred to him that the gases from the core could strike downwards, enter the molten metal and remain under the core until such time as the casting had set.

MR. KILLINGWORTH confessed that this might seem a debatable point. However, he had found this condition many times, and the gas holes themselves had been perfectly clean, and with no signs of any impurities in the gas holes or about them. At first thought, it did appear that the gas blowing from the bottom had a chance to rise and get away, but in those cases where the metal rose steadily to the under side of the core, then the gas from the core was trapped as the metal solidified and had not a chance to escape from the metal. In one instance, for example, when making pistons, that particular trouble was encountered beneath the gudgeon-pin cores, and it was found that when artificial vents were placed in the core the blowholes disappeared.

A MEMBER asked whether the Author had comparable permeability data for cores made on a blowing machine as against those made by hand.

MR. KILLINGWORTH said his experience with core-blowing was limited, but, normally speaking, a blown sand was not necessarily more open. It was more uniformly permeable, and in that way offered better means for the escape of gas. Another point was that with the make-up of sands for blowing there was often a smaller percentage of bonding material than for hand ramming, and there would then be a smaller quantity of gas and lower rate of gas evolution, all adding up to the same thing in the end.

Effect of Using Other Bonds

MR. PAYNE asked for the Author's comments on the following points. First, he had dealt mainly with the gas evolved by the mould material, what was the effect of air inside the mould cavity? Secondly, in the experiments on rates of gas evolution, where silica sand was bonded with ethyl silicate, the permeability was very high, and the rate of gas evolution practically nil. Had experiments been made to measure the mould pressure generated when such a material had been used, *i.e.*, with a mould material which would not itself give rise to gas, and hence would not generate pressure inside the mould. Furthermore, if one took a material with no permeability at all, and bonded it with silicon ester, *i.e.*, no permeability and no gas evolution, but simply pressure due to the expansion of air in the mould cavity, what would the Author expect to happen; would there be formation of blowholes or not?

MR. KILLINGWORTH said unfortunately the use of such material was not a practical proposition, as a silicon ester core was hard and solid after casting and was not much use to the foundryman, except in some very peculiar circumstances. It was just worth while to bear this in mind. The mould pressure developed was almost negligible. Working on the same idea of very low gas content, it would be possible to use very fine sand. The amount of gas developed would be very low. So long as the gas evolution rate was low, then a fine material could be used; with very fine material, then the resistance to the escape of gas was very high, and the air present in the mould did become a factor to be considered. With no gas evolution and no permeability, there would be no blowholes, but if there were no vents of any sort, then the mould would not fill.

A Note on Studs

By "Tramp"

Moulder's studs and chaplets are used extensively in the foundry to counteract the lifting of cores due to the ferrostatic pressure of the liquid metal. Their use, however, should be confined to structural castings and they should not be employed on pressure-resisting castings unless it is impossible to secure the cores by other means, such as by balancing points, bolting back, *etc.*

Should the use of studs in pressure-resisting castings be unavoidable, they should be specially clean and free from foreign matter which might form gas when the metal came into contact with it. When hot, fluid iron of the type used for structural castings, is poured into a mould, a slight evolution of gas stands a chance of escaping before the casting solidfies, but with a high-duty iron of short freezing range, solidification takes place almost instantaneously, thus trapping any gas which may be evolved from a chaplet and causing a weakness which is revealed under the pressure test.

FIG. 1.—TWO TYPES OF STUDS.

The stem of the stud, too, is very important. For pressure work the usual form of straight stem is often replaced by those of shape shown in Fig. 1 (*a*), which shows a chaplet with a hollow around the centre of the stem, and (*b*) where the chaplet stem has a projection. Type (*b*) is better for pressure vessels, because when this class of casting is poured with high-duty iron, the metal rapidly loses fluidity and is very rarely sufficiently hot to flow into the little recess of the type (*a*), whereas even if the temperature be falling rapidly, the stud is held firmly in position when it has a projection shown as in type (*b*).

A New German Welding Journal

Schweissen und Schneiden is the title of a new German monthly magazine covering the whole field of welding. It is the official organ of the German Welding Association, is edited by Dr. Koch, and is published from (20a) Hannover, Technische Hochschule Welfengarten 1. The subscription is 5 marks for a quarter year.

Pig-iron and Steel Production in Great Britain

Detailed Figures for March

The following particulars of pig-iron and steel production in Great Britain have been extracted from the "Statistical Bulletin" for April, 1949, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and ferro-alloys in March, with the number of furnaces in blast; Table II, production of steel ingots and castings in March, and Table III, deliveries of finished steel. Table IV summarises steel-industry activities during the six months ended March, 1949.

TABLE I.—*Weekly Average Production of Pig-iron and Ferro-alloys During March, 1949.* (*Thousands of Tons.*)

District.	Furnaces in blast, 2.4.49.	Hematite.	Basic.	Foundry.	Forgo.	Ferro-alloys.	Total.
Derby, Leics., Notts, Northants, and Essex	24	—	13.7	24.4	2.2	—	40.3
Lancs. (excl. N.-W. Coast), Denbigh, Flints. and Cheshire .. Yorkshire (incl. Sheffield, excl. N.-E. Coast) ..	6	—	6.8	—	—	1.4	8.2
Lincolnshire ..	14	—	24.5	—	—	—	24.5
North-East Coast	23	7.7	34.3	0.6	—	1.5	44.1
Scotland	8	0.8	9.1	3.2	—	—	13.1
Staffs., Shrops., Worcs., and Warwick ..	9	—	8.7	1.4	—	—	10.1
S. Wales and Monmouthshire	8	4.5	19.1	—	—	—	23.6
North-West Coast	7	14.7	—	0.2	—	—	14.9
Total ..	99	27.7	116.2	29.8	2.2	2.9	178.8*
February, 1949 ..	101	28.0	117.1	31.5	1.6	2.9	181.2†
March, 1948* ..	102	26.1	121.4	26.6	1.7	3.0	178.9†

* Five weeks. † Includes 100 tons of direct castings.

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel.* (*Thousands of Tons.*)

Product.	1947 (53 weeks).	1948.	1948.	1949.	
			Mar.*	Feb.	Mar.*
Non-alloy Steel :—					
Heavy rails and sleepers	7.6	8.9	9.2	10.4	10.1
Heavy and medium plates ..	31.6	36.2	37.8	40.3	42.5
Other heavy products	31.8	34.7	35.7	38.9	37.2
Light rolled products§	52.9	59.5	61.0	49.3	49.2
Hot-rolled strip ..				16.0	18.1
Cold-rolled strip ..	4.6	4.7	4.3	4.9	5.1
Bright steel bars ..	4.8	6.0	5.0	6.2	6.3
Sheets, coated and uncoated	24.3	26.3	24.6	29.1	29.1
Tin, terne and blackplate	12.1	13.5	13.6	14.3	14.7
Tubes, pipes and fittings	13.5	15.1	14.9	17.8	19.9
Wire	10.8	12.8	11.6	15.6	15.5
Tyres, wheels and axles	3.5	3.9	3.8	4.0	4.3
Forgings	5.0	6.0	6.1	6.8	6.8
Castings	3.0	3.5	3.7	3.9	3.9
Total	205.5	231.1	231.3	257.5	262.7
Alloy Steel †:—					
Tubes and pipes ..	0.3	0.4	0.5	0.4	0.7
Bars, sheets, strip and wire	3.7	4.7	4.3	5.9	5.4
Forgings	1.8	2.5	2.3	3.0	3.0
Castings	0.6	0.7	0.6	0.8	0.7
Total	6.4	8.3	7.7	10.1	9.8
Total U.K. production‡	211.9	239.4	239.0	267.6	272.5
Less intra-industry conversion ..	19·2	29·0	23·6	35·2	36·8
Net U.K. deliveries ..	192.7	210.4	215.4	232.4	235.7
Add imported finished steel	2.2	3.4	2.6	3.9	6.2
Total deliveries of finished steel ..	194.9	213.8	218.0	236.3	241.9

* Five Weeks. † Excludes high-speed steel. ‡ Includes finished steel produced in the U.K. from imported ingots and semi-finished steel. § Excl. wire rods and alloy steel bars, but incl. ferro-concrete bars.

TABLE II.—*Weekly Average Production of Steel Ingots and Castings, March, 1949.* (*Thousands of Tons.*)

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	—	10.2(Basic)	1.6	0.2	11.4	0.6	12.0
Lancs. (excl. N.-W. Coast), Denbigh, Flints., and Cheshire	1.6	23.0	—	1.3	0.4	25.3	1.0	26.3
Yorkshire (excl. N.-E. Coast and Sheffield) ..								
Lincolnshire	—	29.9	—	—	0.1	29.9	0.1	30.0
North-East Coast	1.8	59.2	—	0.7	0.6	60.7	1.6	62.3
Scotland	5.6	41.2	—	2.3	0.7	48.0	1.8	49.8
Staffs., Shrops., Worcs. and Warwick	—	14.4	—	0.7	0.8	14.5	1.4	15.9
S. Wales and Monmouthshire	10.3	47.5	5.5(Basic)	0.9	0.1	64.0	0.3	64.3
Sheffield (incl. small quantity in Manchester) ..	9.3	26.2	—	7.7	0.6	41.9	1.9	43.8
North-West Coast	0.5	3.0	4.6 (Acid)	0.3	0.1	8.4	0.1	8.5
Total	29.1	244.4	20.3	15.5	3.6	—	—	312.9*
February, 1949	29.0	242.3	20.5	15.7	3.6	302.3	8.8	311.1
March, 1948*	25.9	231.3	17.7	12.5	3.3	283.1	7.6	290.7

* Five weeks.

(*Continued at foot of next page.*)

Obituary

MR. ANDREW BAXTER, late of Harland & Wolff, Limited, Scotstoun, died on May 11.

MR. HARRY TOWERS, managing director of A. Reyrolle & Company, Limited, manufacturing electrical engineers, etc., of Hebburn, Co. Durham, died suddenly on May 17.

MR. ARTHUR CUTHBERT CONNELL, who had been chairman of Charles Connell & Company, Limited, engineers and shipbuilders, of Scotstoun, Glasgow, since 1937, died on May 15. He was 76.

MAJOR AUGUSTUS BASIL HOLT CLERKE, a former joint managing director and deputy-chairman of Hadfields, Limited, Sheffield, died on May 13 at the age of 78. He had control of Hadfields' ordnance department for many years.

MR. DAVID HUTCHINSON HOPPER, who died recently, had for the past four years been in charge of the Sheffield office of Imperial Chemical Industries, Limited. He had been associated with the organisation for more than 25 years.

MR. A. T. SMYTH-TYRRELL, managing director of Baxter, Fell & Company, Limited, iron, steel, metals and minerals merchants and exporters, of Ibex House, Minories, London, E.C.3, died at Cheltenham on May 14 as the result of a car accident.

MR. ANDREW CLIMIE, secretary of Drysdale & Company, Limited, manufacturers of centrifugal pumps and steam engines, of Glasgow, has died after a long illness. He had been associated with the company all his business life. He was 60 years of age.

CAPT. W. R. BAILEY, a director of C. H. Bailey, Limited, shiprepairers, dry-dock owners, etc., of Newport (Mon.), was found shot dead in bed on May 16. A verdict of suicide while the balance of his mind was disturbed was recorded at an inquest held later in the day. Capt. Bailey was 48.

MR. JAMES RAILTON, who died recently at the age of 85, was one of the foremost public works contractors of his day. He also served on the boards of a number of companies. For many years, until he retired on medical advice in January, 1946, he was chairman of Stothert & Pitt, Limited, manufacturers of cranes, excavators, etc., of Bath.

I.C.I.'s Heavy Plant Expenditure

In the main, the supply of the company's products was sufficient to meet industry's full requirements of chemicals and many of the rationing schemes which the company was forced to introduce in 1947 were abandoned during the year, states the annual report of Imperial Chemical Industries, Limited. Referring to the company's large capital programme, the directors point out that the shortage of steel which had been one of the main limiting factors in new construction work was largely remedied towards the end of the year. Expenditure on new plant construction and special maintenance rose from £8,000,000 in 1947 to £14,000,000 in 1948.

Resolutions will be submitted at the annual meeting, to be held in London next Tuesday, to amend the company's articles. In the new articles there is no provision allowing the directors to participate in the profits of the company, but otherwise there is no change in the articles dealing with directors' remuneration.

Engineers' Wage Proposals

Proposals for the establishment of a new wages structure for the engineering industry were discussed, and the Engineering Sub-committee's report presented by Mr. Jack Tanner was carried by a four-to-one majority at the annual conference of the Confederation of Shipbuilding and Engineering Unions at Belfast on May 18. The proposals cover six grades of workers and range from 96s. for labourers to 120s. for skilled operatives, plus special rates for specified categories. Mr. Tanner stated that unless increased wages were forthcoming and the status of craftsmen improved, it would be impossible to obtain recruits to the industry.

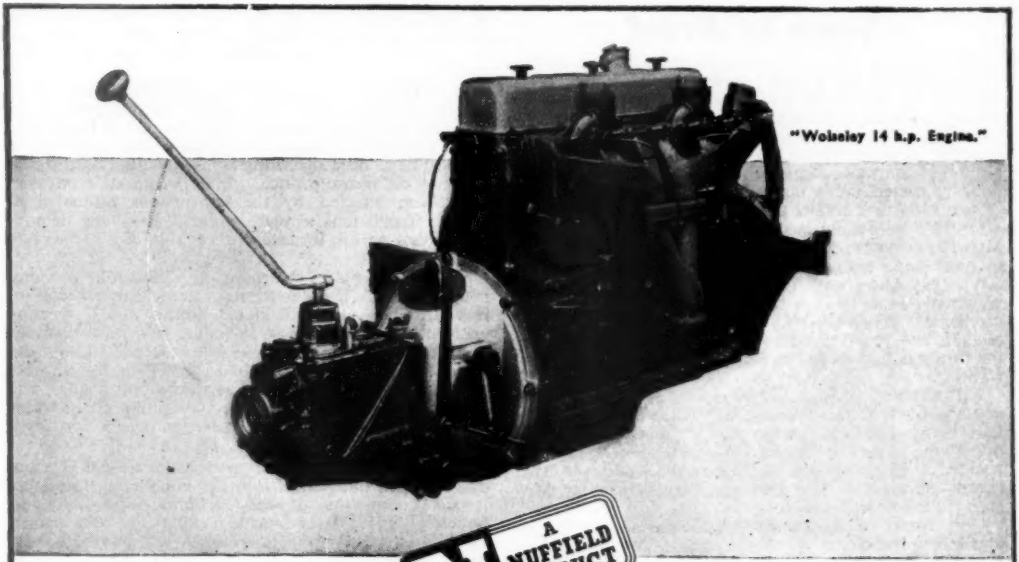
APPLICATION IS BEING MADE shortly to the Council of the Stock Exchange, London, for permission to deal in 150,000 6 per cent. cumulative preference £1 shares and 190,000 ordinary £1 shares, the whole of the issued share capital of the Caledon Shipbuilding & Engineering Company, Limited, Dundee.

PIG-IRON AND STEEL PRODUCTION IN GREAT BRITAIN (*Continued from previous page*).

TABLE IV.—*General Summary of Pig-iron and Steel Production.* (*Weekly Average in Thousands of Tons.*)

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy).			
						Imports.‡	Output of ingots and castings.	Deliveries of finished steel.	Stocks.†
1938	228	89	—	130	118	16	200	—	—
1947 (53 weeks)	209	136	165	147	145	8	240	195	797
1948	252	172	200	178	174	8	286	214	1,028
1948—October	270	175	202	183	184	13	297	223	1,004
November	264	174	205	185	187	13	303	229	1,002
December*	253	162	201	176	173	10	282	216	1,028
1949—January	269	163	202	178	178	8	289	224	1,019
February	267	160	201	181	198	13	311	236	1,000
March*	263	158	198	179	199	20	313	242	1,031

* Five weeks. † Stocks at the end of the years and months shown. ‡ Weekly average of calendar month.



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REFINED PIG IRON

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ENGINEERING CASTINGS

THE STANTON IRONWORKS COMPANY LIMITED, Nr. NOTTINGHAM

News in Brief

THE FORMER U.S. DESTROYER ROXBURGH, one of the 50 transferred to Britain during the war, has been brought to the Tyne for breaking-up by Clayton & Davie, Limited, Dunston.

BRITISH RAILWAYS is to build 465 locomotives, 1,972 coaching vehicles and 27,225 wagons under its 1949 programme. Shortage of materials and workshop capacity have restricted the programme.

A TEXTILE MACHINERY EXHIBITION, the first to be held since 1938, will be opened by the Minister of Supply at Manchester on October 12. Demand for space has been so great that a temporary extension hall is to be erected.

VICKERS-ARMSTRONGS, LIMITED, has begun work at Newcastle-upon-Tyne on a £1,000,000 order for heavy mechanical presses for Russia. The order is expected to take two years to complete. This is the first order the firm has had from the Soviet Government since the war.

J. PARKINSON & SON, manufacturers of machine tools and vices, of Shipley, Yorks, announces that the firm has been registered as a private limited company, under the title of J. Parkinson & Son (Shipley), Limited. The business will be continued by Mr. Ernest Parkinson, Mr. Edward Parkinson, and Mr. Harry Parkinson, as before.

THE THIRD of the British industrial teams to go to the United States at the invitation of the Anglo-American Council on Productivity will be drawn from the drop-forging industry. Mr. H. A. Wallace, of B. & S. Massey, Limited, Openshaw, Manchester, will lead the team, which sails on June 10 for a six-week investigation of American conditions.

THE ANNUAL GENERAL MEETING of Craven Bros. (Manchester), Limited, machine-tool makers, manufacturers of gearing machines, etc., is to be postponed until the chairman (Mr. J. R. Greenwood) returns from a visit he is making to the United States and Canada, which is expected to be about the end of June. Mr. Greenwood left this country on May 17.

A NATIONAL ARBITRATION TRIBUNAL adjudicating on a claim that workers employed by L. Sterne & Company, Limited, manufacturers of refrigerating machinery, at its Hillington (Glasgow) works on a premium bonus system should be paid for all bonus hours at the shop basic rate of 1s. 6½d. per hr., found that it had not been established, and awarded accordingly.

THE HARLAND ENGINEERING COMPANY, LIMITED, Alloa, Scotland, has received a contract from the Argentine for three new electric pumping installations, a fourth having already been erected. The capacity of the installations is estimated to be sufficient to provide the water supply of Buenos Aires. The company obtained the contract in the face of competition from the United States, France, Switzerland, and Italy.

THE DIRECTORS OF Cammell Laird & Company, Limited, announce that approval has been given by the Treasury to the capitalisation of the company's reserves to the extent of £1,775,000, and the application of that sum in paying up in full 7,100,000 unissued ordinary shares of 5s. each, and the distribution of these shares as fully paid shares among the stockholders, in the proportion of one ordinary share of 5s. in respect of each ordinary stock unit of 5s. now held.

IT IS HOPED to complete this year the conversion of the 14 open-hearth steel furnaces at the Templeborough Works of the Steel, Peech & Tozer branch of the United Steel Companies, Limited, to liquid fuel. For some time 10 have been operating on liquid fuel, eight on oil and two on creosote pitch. Important coal economies have been effected by the conversions estimated at about 150,000 tons a year, while it has been demonstrated that on oil, furnaces are capable of a higher rate of output.

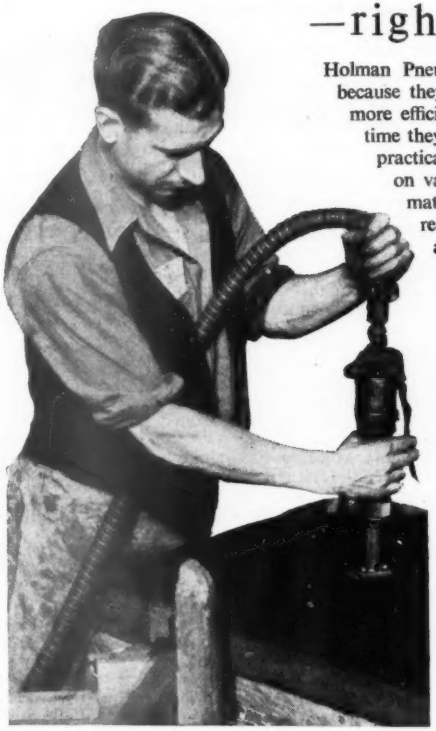
SIR CLAUDE GIBB, chairman of A. Reyrolle & Company, Limited, manufacturing electrical engineers, of Hebburn, Co. Durham, stated at the annual meeting on May 17, that between 1946, the first post-war year in which the company's facilities were entirely devoted to their normal products, and 1948 the number of employees increased by less than 5 per cent. The physical output, however, after correcting for changes in selling prices, increased by more than one-third over that period.

A CIRCULAR TO SHAREHOLDERS of British Steel Constructions (Birmingham), Limited, concerning the delay in the completion of the accounts for the year to August 31, 1947, states that the claim of £100,000 against the Ministry of Works is still the subject of negotiation. Having regard to the further delay, the board feels that there is no alternative but to complete the accounts for the two years 1947 and 1948 without taking any credit for the claim. Steps are to be taken to adjust the capital position of the company.

THE NATIONAL UNION OF MANUFACTURERS, in a brochure entitled "An Outline of Policy for Industry," calls for a new conception of the place and function of industry in the national economy and demands that industry shall take a greater part in the formation of economic policy in view of the heavy responsibility placed upon it for the country's trade recovery. It also calls for adequate incentives for all engaged in industry in whatever capacity, makes suggestions regarding human relationships, and re-states its faith in free enterprise.

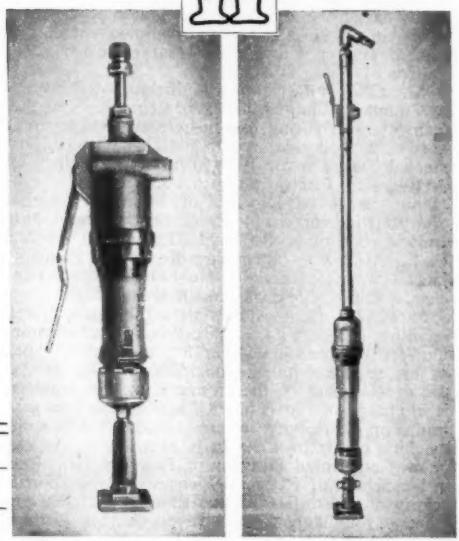
VICKERS, LIMITED, announces that approval has been given by the Treasury to the capitalisation of the company's reserves to the extent of £6,157,742 and the application of that sum in paying up in full 12,315,484 unissued ordinary shares of 10s. each and the distribution of these shares as fully-paid shares among the stockholders in the proportion of one ordinary share of 10s. in respect of each ordinary stock unit of 10s. now held. An extraordinary general meeting of the stockholders will be called at an early date for the purpose of giving approval to this issue and to the consolidation and conversion of the new ordinary shares of 10s. each and the existing ordinary stock units of 10s. each into ordinary stock units of £1 each. If this is approved, the 12,315,484 existing ordinary stock units of 10s. each become of a par value of £1, being the par value of the ordinary shares of the company in issue before the capital reduction in 1926.

Holman Pneumatic Rammers —right on top of the job



Holman Pneumatic Rammers are welcomed by workers in many industries because they cut out the toil of packing loose materials, doing the job far more efficiently and quickly than it can be done by hand. At the same time they please managements because they save time and labour and are practically foolproof. Their special feature is their effectiveness even on varying levels of material, the piston stroke adjusting itself automatically. The range covers almost all "bench" and "floor" requirements, and various sizes and shapes of butts and peins are available. Full details and recommendations supplied on request.

Type	Size	Length ins.	Weight lbs.
Bench ...	0	17	9
Bench ...	10	23	18
Floor ...	20	48	22
Floor ...	30	47	27



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H.13

Personal

MR. S. BATES, secretary of the Consett Iron Company, Limited, has been appointed a magistrate.

MR. A. J. MILNE, general manager of the Alumilite & Alzak, Limited, group of companies, has been appointed managing director.

MR. N. H. BIRDSEYE, of Braithwaite & Company, (Structural), Limited, has been appointed vice-chairman of the Council of British Manufacturers of Petroleum Equipment, in succession to MR. ROBERT GOURLAY, of A. F. Craig & Company, Limited, Paisley.

MR. P. E. GAZE, who, for several years, has been engaged on the detail handling of the British Thomson-Houston Company's switchgear work for 132-kv. and lower voltages, has been appointed assistant manager of the switchgear sales department at Willesden.

DR. G. V. SLOTTMAN, who was chief combustion engineer and ironworks manager for the United Steel Companies, Limited, Sheffield, from 1930-34, when he went to the United States to join the Air Reduction Company, has now been appointed director of research and engineering for that company. He is a native of New York.

MR. GEORGE S. CROMAR, a director of Barclay, Curle & Company, Limited, and general manager of the company's shiprepairing establishments at Elderslie Dockyard and Clydeside Repair Works, Glasgow, has been elected chairman for 1949-50 of the Dry Dock Owners & Repairers Central Council. During the war he was Deputy Regional Director of Merchant Shipbuilding and Repairs for the West of Scotland and Northern Ireland, becoming Regional Director in 1942. MR. E. L. CHAMPNESS, managing director of Palmers Hebburn Company, Limited, Hebburn-on-Tyne, has been elected senior vice-chairman of the Council.

PROF. M. L. E. OLIPHANT, the atomic research scientist, is resigning as Vice-Principal of Birmingham University from September 30, because of "pressure of his departmental responsibilities." He worked on the development of the atomic bomb in America, and is in charge of the Nuffield Physics Laboratory at Birmingham University, where a large "atom-splitting" machine of his own design is being built. In October he was appointed Director of Post-Graduate Research in the School of Physical Sciences at the National University of Australia. It was thought that the appointment was unlikely to involve his leaving Birmingham for several years.

SIR ARTHUR J. SMOUT, director of Imperial Chemical Industries, Limited; MR. J. J. GRACIE, general manager of the General Electric Company Limited, Witton; MR. J. A. HUNT, general manager, Hymatic Engineering Company, Limited; MR. F. W. LAWTON, Midlands Divisional Controller, British Electricity Authority; DR. W. WILSON, manager of the development laboratories of the General Electric Company, Limited, Witton; DR. H. B. KEENE, sometime head of the Department of Mathematics and Physics, Birmingham Central Technical College; and MR. THOMAS H. ESSERY, sometime head of the engineering design section of Birmingham Central Technical College, have all received Honorary Associateships of the Birmingham Central Technical College.

Parliamentary

Government's Metal Purchases

COL. CROSTHWAITE-EYRE asked the Minister of Supply the total amount of hard currency expended by H.M. Government since the beginning of the present financial year to secure zinc, copper and lead, and if he would state a comparable figure if these materials had been secured at world prices ruling at the date of their delivery.

MR. STRAUSS, in reply, said that £4,693,382 was paid in hard currencies between April 1 and May 7 for metal previously ordered and mostly shipped in March and April. Since there was a steep fall in prices in these months this metal, if purchased at the date of delivery, would have cost about 15 per cent. less. The necessary supplies for early delivery could not, however, have been assured in this way and, moreover, for some of this metal there must in any case be a time-lag of several weeks between purchase and delivery. For these reasons any hypothetical cost comparison of this kind was wholly misleading.

"Surely the Minister has made the very hypothetical comparison which he says he cannot make in the case of forward purchases," said COL. CROSTHWAITE-EYRE. "Would not he be able to give some indication as to how far his Ministry has committed this country to long-term contracts at prices above the world prices, and give the date when those contracts will run out, and further is this not the final proof that the London metal market ought to be reinstituted?"

MR. STRAUSS said it was quite wrong to say that we were committed to long-term contracts. Most of our contracts were for about three months.

COL. CROSTHWAITE-EYRE: "On that basis of three months, what is the total that the Minister will have to pay in hard currency over and above world prices if he had bought on a free market?"

MR. STRAUSS said he could not say what was going to happen in the future, the prices might fall or rise. He said he had answered the question as well as he could. Taking certain factors into account it would be round about 15 per cent. which might well be hypothetical.

MR. EDEN asked if the Minister could assure the House that his mind was not closed to the reopening of the metal market in London at the earliest possible moment.

MR. STRAUSS: "As I said earlier, the matter is under review by the Government."

MR. EDEN: "It has been under consideration for a long time."

A TEST SURVEY is being conducted among its members by the Engineering Industries Association in the belief that considerable hidden unemployment exists in the industry and that manufacturers are building for stock to avoid breaking up established production teams. Each of the Association's 3,500 member firms is being asked to state the percentage increase or decrease of its labour force during the past six months, and also the trend of its order-book over the same period. It is hoped to be able to make a reliable assessment of employment in the engineering industry.

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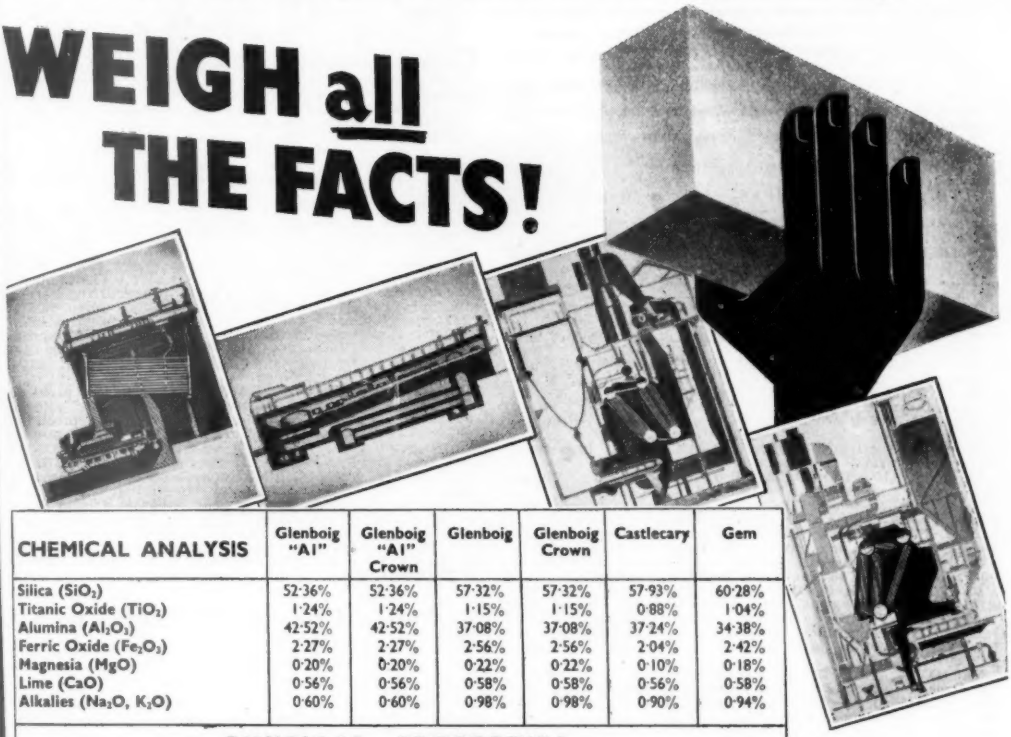

CHEMICAL ANALYSIS	Glenboig "Al"	Glenboig "Al" Crown	Glenboig	Glenboig Crown	Castlecary	Gem
Silica (SiO_2)	52·36%	52·36%	57·32%	57·32%	57·93%	60·28%
Titanic Oxide (TiO_2)	1·24%	1·24%	1·15%	1·15%	0·88%	1·04%
Alumina (Al_2O_3)	42·52%	42·52%	37·08%	37·08%	37·24%	34·38%
Ferric Oxide (Fe_2O_3)	2·27%	2·27%	2·56%	2·56%	2·04%	2·42%
Magnesia (MgO)	0·20%	0·20%	0·22%	0·22%	0·10%	0·18%
Lime (CaO)	0·56%	0·56%	0·58%	0·58%	0·56%	0·58%
Alkalies (Na_2O, K_2O)	0·60%	0·60%	0·98%	0·98%	0·90%	0·94%

PHYSICAL PROPERTIES

Refractoriness	Seger Cone 34 (1750°C)	Seger Cone 34 (1750°C)	Seger Cone 32/33 (1720°C)	Seger Cone 32/33 (1720°C)	Seger Cone 32/33 (1720°C)	Seger Cone 31/32 (1700°C)
Refractoriness U/L of 2 kilos/sq. cm.	1630°C	1610°C	1610°C	1580°C	1600°C	1580°C
Refractoriness U/L of 50 lb./sq. in.	1580°C	1530°C	1530°C	1510°C	1520°C	1510°C
Thermal (Reversible) Expansion—mean co-efficient X 10^{-5}	0.568	0.522	0.584	0.540	0.562	0.623
Porosity—Total Percentage by Volume	18/20	24/26	18/20	24/25	16/20	16/20

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GLENBOIG FIREBRICKS

EXPORT AGENTS: GENERAL REFRACTORIES LTD., GENEFAX HOUSE, SHEFFIELD, 10

Company News

(Figures for previous year in brackets.)

BLUEMEL BROS.—Interim dividend of 2½% (same).

WORTHINGTON-SIMPSON—Dividend of 20% (same).

WEARDALE LEAD COMPANY—Interim dividend of 4% (nil).

ENFIELD CABLES—Final dividend of 3⅜%, making 7½% (same).

MARSHALL SONS & COMPANY—Interim dividend of 3⅜% (same).

BRITISH AUTOMATIC COMPANY—Dividend of 6% (same).

CANNON IRON FOUNDRIES—Interim dividend of 5% (same).

E. G. BROWN & COMPANY—Interim dividend of 10% (same).

MASON & BURNS—Dividend of 10% (same) and bonus of 10% (nil).

RHEOSTATIC COMPANY—Final dividend of 14%, making 20% (same).

ALLEN WEST & COMPANY—Dividend of 7½% and bonus of 2½% (same).

PEGLERS—Dividend of 45% on the "A" and "B" ordinary shares (same).

RICHARD JOHNSON & NEPHEW—Final dividend of 10%, making 15% (same).

DUNLOP RUBBER COMPANY—Dividend of 12% and bonus of 3% (same).

RANSOMES, SIMS & JEFFERIES—Dividend of 7½% on increased capital (7½%).

BROOKE TOOL MANUFACTURING COMPANY—Interim dividend of 7½% (same).

ALEXANDER DUCKHAM & COMPANY—Final dividend of 15%, making 22½% (same).

H. & S. (HOLDINGS)—Final dividend of 7½%, making 10% (same) and 40% share bonus (nil).

S. RUSSELL & SONS—Interim dividend of 7½%. The company was made public in July, 1948.

W. J. HARRIS & COMPANY—No payment on the ordinary shares (5%). The 7½% preference dividend for the year to June 30 next will be paid on July 1. The half-yearly preference dividend due on January 1 last was not paid.

BRIGGS MOTOR BODIES—Net profit, after tax, for 1948, £513,761 (£543,414 adjusted); profits relating to previous years, £5,250 (£22,412); to general contingency reserve, £100,000 (£50,000); reserve towards increased costs of replacement of fixed assets, £325,784 (nil); dividend of 12½% (same); forward, £127,050 (£103,573).

NATIONAL ELECTRIC CONSTRUCTION COMPANY—Revenue for 1949, £88,415 (£89,463); to management expenditure, £3,244 (£1,615); directors' remuneration, £2,700 (same); audit fee, £42 (same); tax, £38,550 (£40,400); leaving £43,879 (£44,706); dividend from subsidiary, £4,770; dividend of 10% (same); undivided profits account, £38,474 (£34,531).

F. FRANCIS & SONS—Group trading profit for 1948, £222,539; to directors' emoluments, £16,825; auditors' remuneration, £412; depreciation, £15,933; deferred repairs, £11,500; net profit, £177,869; brought in, £55,709; to tax, £95,350; contingencies, £25,000; subsidiary general reserve, £20,000; preference dividend, £6,050; final ordinary dividend of 15%, making 20% (same); forward, £62,428.

RUTHS INTERNATIONAL ACCUMULATORS—Accounts issued cover two years to December 31, 1948. They show a loss of £554 for 1948, against a loss of £35 for 1947; adverse balance carried forward, £70,869. The auditor states that, subject to the value of fixed assets and to the fact that provision is not being made for amortisation of patent rights, the balance-sheet gives a true and fair state of company's affairs.

SANBRA—Consolidated trading profit for 1948, £254,236; other income, £2,513; to depreciation, £21,776; income tax, £92,261; profits tax, £27,350; net profit, £115,377; to additional depreciation on properties, £5,000; off goodwill, Conex-Terna, £3,024; retained by subsidiaries, £23,874; parent company's profit, £83,479; brought in, £15,311; final dividend of 12½%, making 20%; general reserve, £33,100; stock metal reserve, £35,000; forward, £18,700.

KERRYS (GREAT BRITAIN)—Consolidated trading profit for the year ended December 31, 1948, £206,620 (£241,564 for 10 months ended December 31, 1947); to directors' emoluments, £12,754 (£14,413); directors' pension, etc., £958 (£500); depreciation, £25,476 (£21,214); leaving £167,432 (£205,437); brought in, £80,166 (£71,207); to tax, £91,328 (£114,811); staff pension scheme, £7,000 (£6,000); general reserve, £21,762 (£50,000); preference dividend, £6,050 (£5,042); ordinary dividend, £24,750 (£20,625); forward, £96,708 (£80,166).

GARRARD ENGINEERING & MANUFACTURING COMPANY—Trading profit to January 31, £216,579 (£103,545); further claims accrued on cessation of wartime contracts, £8,490; to provision for E.P.T. payable thereon, £8,490; leaving nil (£10,246); to depreciation, £20,698 (£14,226); directors' emoluments, £24,907 (£13,773); estimated tax, £90,444 (£39,154); net profit, £80,530 (£46,638); capital profits on sales of plant, etc., £1,638 (nil); to additional depreciation of buildings, £6,500 (£10,000); staff pensions, £9,649 (£20,000); dividends: preferred ordinary £4,125 (same), ordinary 25% £12,516 (same); general reserve, £44,900 (nil); forward, £30,080 (£25,602).

BRADLEY & COMPANY—Trading profit for 1948, £66,020 (£59,445); dividends from subsidiary companies, £10,317; dividends on trade investments, etc., £11 (£555); to auditors' remuneration, £578 (£350); depreciation, £9,006 (£5,873); buildings depreciation, £643 (same); outgoings for freehold properties, £547 (nil); debenture interest, nil (£900, the 5% debentures were repaid in April, 1948); non-recurring expenditure, nil (£9,720); net profit, subject to taxation, £65,574 (£42,514); to tax, £32,855 (£26,042); net profit, £32,719 (£16,472); preference dividend—on rearranged and increased capital for the 10 months to December 31, 1948—absorbs £5,729 (£1,320); ordinary dividend of 70% (same); forward, £53,447 (£44,707).

TEXTILE MACHINERY MAKERS—Consolidated profit and loss account for 1948 shows balance from trading accounts, plus other income, £2,224,785 (£758,149); to depreciation, £281,282 (£194,238); auditors' charges, £2,304 (£2,201); terminal expenses, nil (£16,576); deferred repairs, nil (£130); taxation, £945,553 (£323,927); minority interests, £2,143 (£3,337); net profit, £993,503 (£217,740); provisions no longer required, nil (£50,818); transfers from general reserve, nil (£56,218); to writing down of stock and work in progress arising out of change in basis of valuation, £76,115 (nil); additional taxation for previous years, £159,506 (£95,267); to reserves in respect of increase in replacement costs of fixed assets, £400,000 (nil); general reserve, £200,000 (nil); dividend of 6% (same); forward, £422,053 (£373,260).

National Gas & Oil Engine Co.

Control over the National Gas & Oil Engine Company, Limited, Ashton-under-Lyne, has been assumed by Mr. A. P. Good, who, at the meeting on May 12, was elected acting chairman, succeeding Lord Falmouth, who retired from the board after being chairman for 17 years. Mr. Good assured the meeting that he and his associates who had acquired majority control of the capital had no intention of interfering with the existing management or policy. Mr. E. M. Benjamin, an associate of Mr. Good, was later elected a director of the company by the board. Mr. Good is to continue as acting chairman until an independent chairman is elected to succeed Lord Falmouth.

Law Report

Foundrymen's Capital Reduced

Mr. Justice Wynn-Parry, in the Chancery Division on May 16, confirmed a reduction of the capital of Bromsgrove Guild, Limited, bronze and iron founders, of Bromsgrove, Worcs, from £20,000 to £15,000 by returning capital in excess of the wants of the company. Counsel for the company said it was proposed to return 5s. per share on the company's 20,000 £1 shares. There were only two shareholders and the position of the company was extremely strong.

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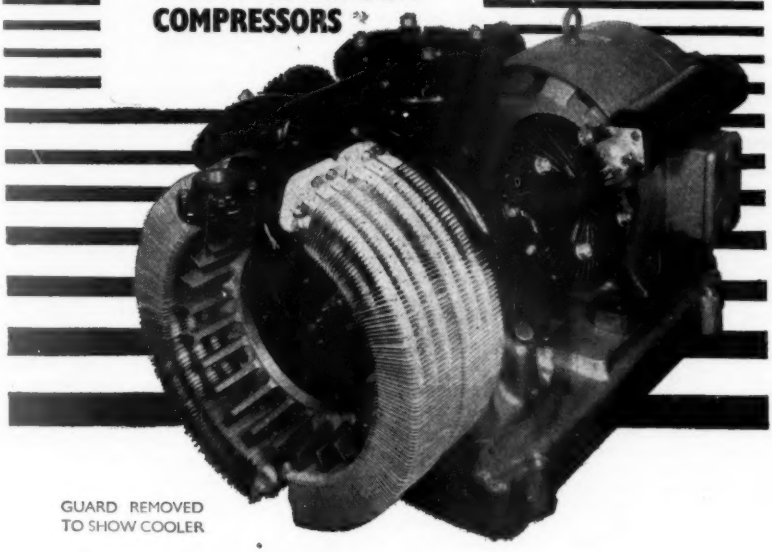

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Raw Material Markets

Iron and Steel

Foundries are still beset by many difficulties regarding supplies of pig-iron, both in respect of quantity and grade. Most of them are still unable to meet their requirements, and in numerous cases deliveries fall far short of licensed tonnages, although permits granted for supplies are reduced to a minimum and only allow for three weeks' stock if full allocations can be obtained. This applies particularly to the light foundries, whose supplies of high-phosphorus iron continue to be unreliable. Tonnages will no doubt show some improvement when the furnaces now being relined are again in blast, but the overall position will not show any marked increase until additional units are provided.

The engineering jobbing and speciality foundries are using up all the low- and medium-phosphorus iron they can obtain. The demand for this grade is greater than production can satisfy, and the furnaces find it necessary to ration supplies to consumers. The same conditions apply in the case of hematite, and allocations made by the furnaces are frequently interfered with by the prior claims of the steel trade, whose supplies of pig-iron are even more precarious than those of the foundries. In some cases foundries have been able to ease the position by taking additional quantities of the refined grades. Coke continues to be supplied at allocated levels and both quantity and quality are generally satisfactory. Ferro-alloys are coming forward satisfactorily and limestone and ganister can be obtained without much difficulty.

The output of small sections, bars and narrow strip from the light re-rollers, continues on an improved scale, proportionate to the increase in supplies of small square and flat billets which are coming forward, chiefly from the Continent. There is a still a heavy demand for these sizes, and bigger tonnages of semis could be absorbed. Users will, however, have to rely mostly on supplies from abroad, as deliveries from home sources are inadequate. Steel sheets are being obtained more freely, but not in sufficient quantities to meet all demands. The mills are using up readily all available supplies of sheet bars, but more are needed, as the demand for sheets is so heavy that it is difficult to place fresh orders.

The heavy re-rollers are receiving good tonnages of the larger sizes of billets, blooms and slabs and their outputs are satisfactory. The steelworks have no difficulty in disposing of their accumulation of defective billets, slabs and crops.

Non-ferrous Metals

It will be interesting to see whether the United Kingdom figures for April consumption of copper show a fall comparable with the American deliveries to domestic users. True, the basis of comparison is not quite the same, for the U.K. total is in terms of consumption, virgin and secondary, whereas the U.S. statistics are for deliveries of refined metal. But as will be seen from the following details, issued by the Copper Institute, there has been a sharp setback in America, which may or may not be only temporary. Production of crude copper in April was 91,629 short tons, compared with 96,085 tons in March, while the output of refined metal rose from 88,165 short tons to 93,866 tons. The slump came in deliveries, which fell by nearly 38,000 short tons to no more than 76,127 tons, the lowest level reached for some time. Stocks of refined copper increased to 76,494 short tons from 68,450 tons at March 31, an addition of 8,044 tons on the month. It is, of course, true that American consumers tend to buy for fairly nearby dates, so that it may be presumed that the lower rate of deliveries is due to less buying, dictated in turn by fears about the price recession.

During the past week or so the tone of the market in the U.S. has been rather firmer, copper having risen by 25 points to 18¼ cents and zinc by ¼ cent to 12¼ cents per lb. These increases are in themselves, perhaps, insignificant in comparison with the extent of the recent fall, but they do serve to show that the end of the fall has been reached for the present. It may well be that now the American consumers have begun to buy to a modest extent, a much steadier tone will prevail, but it does not follow from this that there is going to be a further rise in values. At the best, the present levels will be maintained for a few months before the next development takes place. It is very likely that weighing up the pros and cons of the situation, the producers will not be too keen to see the price curve moving sharply upwards again. Erratic and changeable markets are no good to anybody, and if stability can be achieved and maintained at about the present levels it will be far more satisfactory. In the meantime, scrap prices in the U.K. are steady, but there is little business being done.

Supply Ministry's Profit on Copper

Sir Frank Tribe, Comptroller and Auditor-General, in his report covering examination of 1947-48 trading accounts of various Government departments, including the Board of Trade and the Ministry of Supply, states that the latter operated its trading services at a profit of £6.7 million, omitting the writing off to capital of a subsidy of £4.3 million, but the profit would have been cut to £3.1 million had the account been charged the average prices paid for ordinary purchases of copper.

Copper recovered from scrap was entered at prices ruling at the date of refining contracts, and as these proved to be much less than values actually realised on sale, the trading outcome was improved. The Ministry's profit arose mainly on non-ferrous metals (£6.1 million) and aluminium and silicon (£472,231).

A RECORD NUMBER of overseas buyers attended the British Industries Fair which closed on May 13. In 11 business days the Fair was visited by 16,740 overseas trade buyers. This was three times the pre-war level and compares with totals of 16,710 and 14,333 respectively at the two previous post-war Fairs.